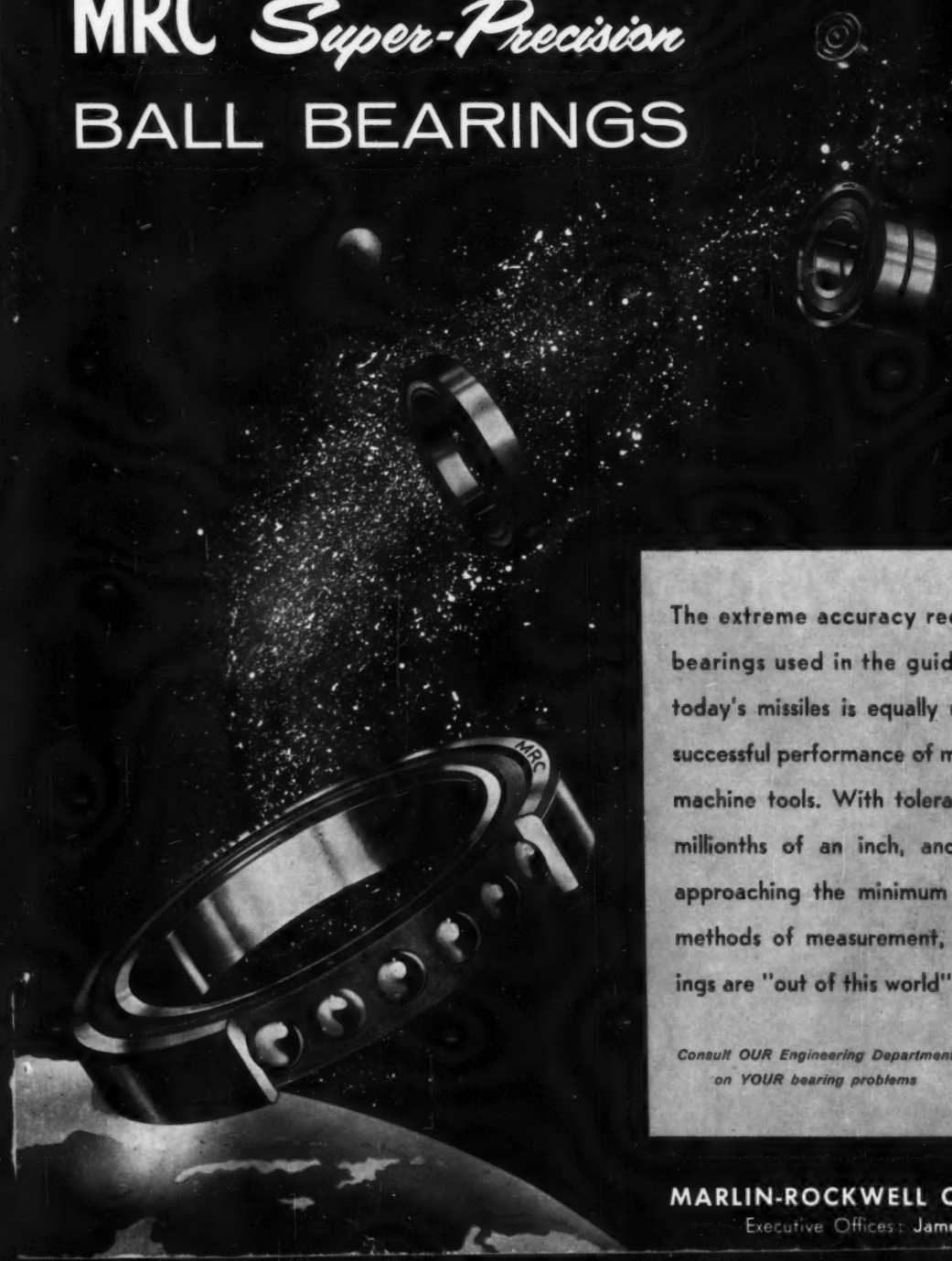
OCTOBER 1958 – SIXTY-FIFTH YEAR

Machinery

MRC *Super-Precision* BALL BEARINGS



The extreme accuracy required in M-R-C bearings used in the guidance systems of today's missiles is equally necessary for the successful performance of modern high-speed machine tools. With tolerances measured in millionths of an inch, and surface finishes approaching the minimum limits of existing methods of measurement, M-R-C Ball Bearings are "out of this world".

Consult OUR Engineering Department on YOUR bearing problems

MRC
BALL AND ROLLER *bearings*

MARLIN-ROCKWELL CORPORATION
Executive Offices: Jamestown, N. Y.

it's mainly a matter of TIMING!



Q. ***WHEN should you replace a machine?***

A. ***When you can do it at a PROFIT!***



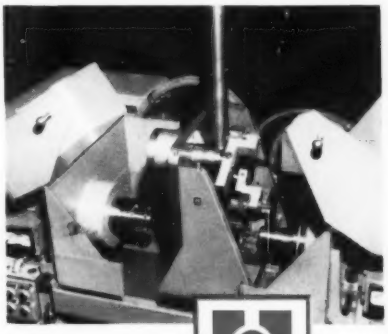
Obsolescence is an insidious thing. It can overtake any machine—even a relatively new one—without warning. And when it does, you're producing at a *loss*.

The only way to catch it in *time* is to make frequent studies, comparing the production cost of the old machine with that of the new one that might replace it. Then weigh these costs in terms of investment and return. Up to a certain point, the old machine will still be profitable to operate. Beyond that point, it's running *in the red*.

Heald sales engineers are well experienced in precise methods of replacement analysis. And they will be glad to help you determine when you can replace an existing machine *at a profit*. Similar cost studies by Heald engineers have pointed the way to many important cost savings.

For example: This new Heald Model 322 Bore-Matic replaced a heavy-duty drill for boring and chamfering hydraulic-cylinder piston rods. A cost analysis determined that the investment in a new machine could not be deferred any longer without serious financial loss. As verified by subsequent operation, the new machine offered the following savings:

	Old Machine	New Machine
Parts per hour	11	24
Machine load, per year	3,080 hrs.	1,380 hrs.
Direct & Indirect Labor	9,480 hrs.	3,240 hrs.
Annual Maintenance	$356	$100
Annual Operating Cost	$27,800	$15,000
Annual Saving, New Machine		**$12,800**
Net Return on Investment		39.6%



YOU pay for obsolescence. Replacement pays for itself!

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Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York



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Machinery

OCTOBER 1958 **VOL. 65 No. 2**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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Exceptional Tool Life

This excellent performance is another example of how LANDIS equipment and knowledge solves threading problems the most economical and efficient way.

. . . threading at fast production rate

A LANDEX Hardened and Ground Die Head threads 5000 pipe plugs between chaser grinds at the rate of 800 per hour at the Safety Socket Screw Company, Chicago, Illinois, manufacturers of "Blue Devil" socket screw products.

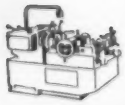
⅜" 18 pitch N.P.T. threads were cut on 4140 annealed steel (15-20 Rockwell "C"). Threading was performed at approximately 27 surface feet per minute by a ⅞" LLL LANDEX Head on a tapping machine.

This high production and excellent chaser life is the result of over 50 years experience by the LANDIS MACHINE COMPANY in the development and exclusive manufacture of threading equipment. For example, in the area of chaser design, chasers are given special hardening when workpiece design or material specifications so indicate. A LANDEX Hardened and Ground head was used in this application because of the inherent qualities of hardened and ground construction to enable long life, trouble free operation and the rigidity necessary for maximum thread cutting accuracy. The LANDEX Head is a revolving die head unmatched for precision threading and true economy for application to automatic screw machines and other types of machines employing a live spindle.

LANDEX Heads are available in four sizes that will thread diameters from No. 4 to 1¼" and ⅛" to ¾" pipe. Let us show you the type and size head that will offer you precision threading and true economy. Send specifications and ask for Bulletin F-80-7.

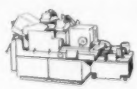
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THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

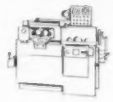

Threading Machines


Die Heads—Rotary & Stationary

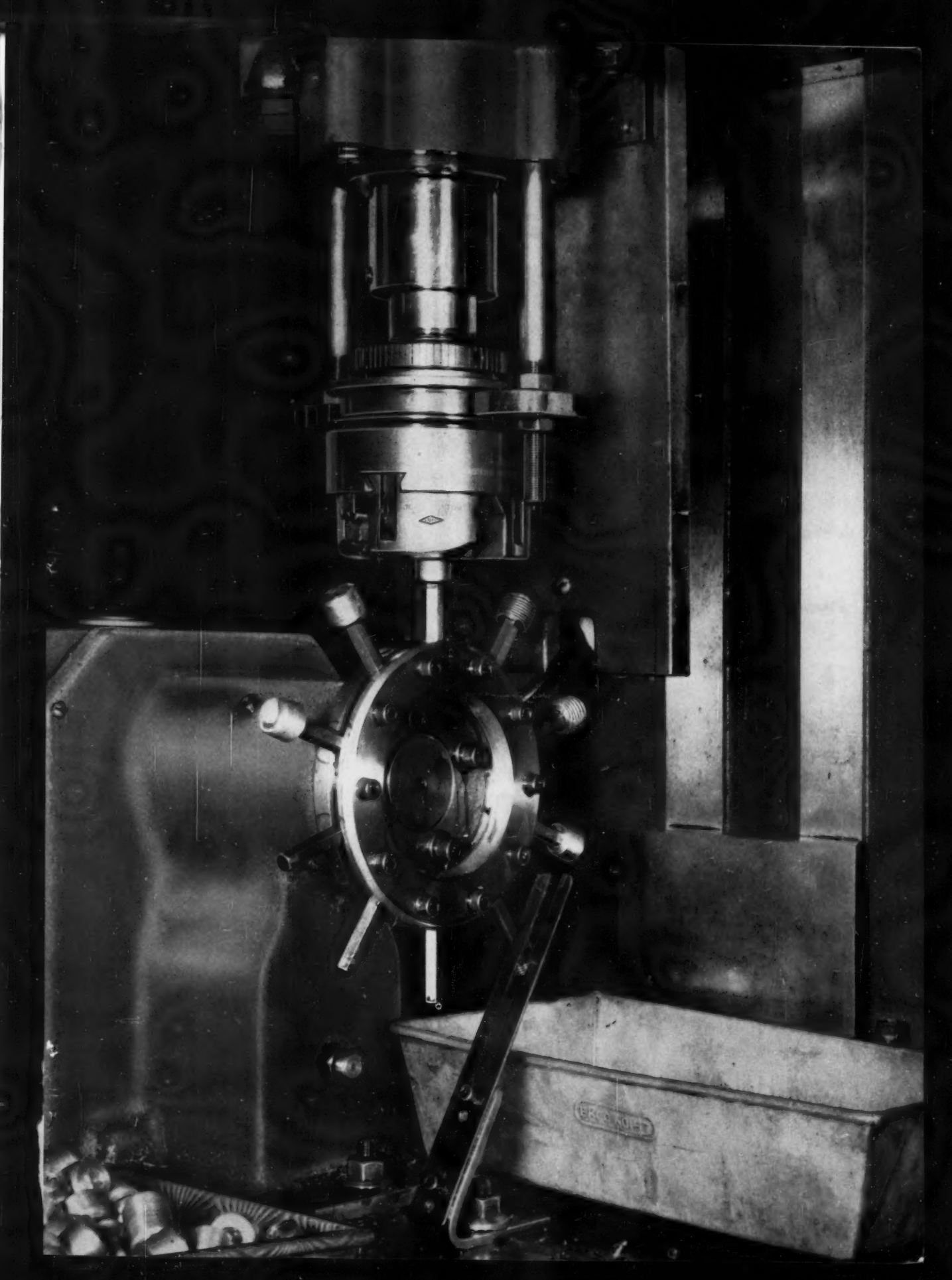

Taps—Collapsible & Solid Adjustable


Centerless Thread Grinding Machines


Thread Rolling Tools

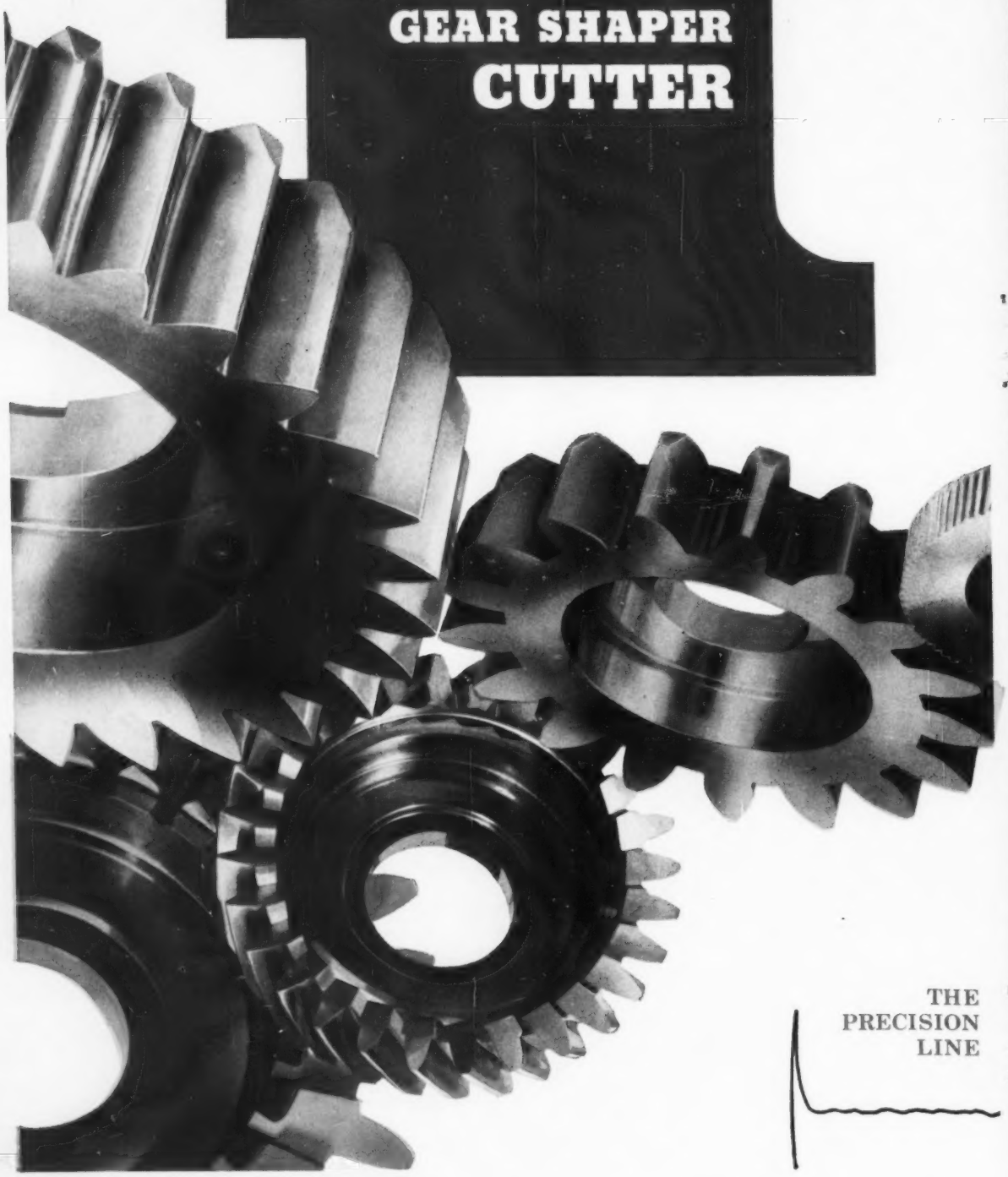

Thread Rolling Machines

529C



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...and



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FELLOWS

still makes the BEST

The Fellows Cutters you order today have unequalled experience behind their manufacture: the first gear shaper cutter ever made was designed, produced and patented by Fellows in 1897. Hundreds of thousands of Fellows Cutters have been made and used on gear production lines since that time.

This vast experience has resulted in constant progress, year after year, in cutter design and manufacture. Today, new gear and cutter designs are checked on a high-speed electronic computer which permits complete mathematical study of all possibilities. Constant advances in metallurgy and in manufacturing methods assure outstanding cutter performance on every gear production job.

A booklet, "Fellows Gear Shaper Cutters", covers the subject in detail. It includes tables of stock cutters, design considerations, sharpening methods, and other information. For a copy, contact any Fellows office.



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Fellows *Gear Production Equipment*

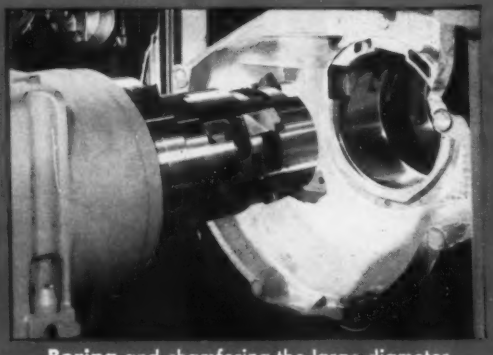
Cincinnati 26-Station

Mills, Drills, Bores . . .
Ford Automatic Transmission Cases

Transmission cases require gentle handling; firm, balanced clamping; experienced machining. All these requirements are incorporated in the CINCINNATI 26-Station Unit Type Transfer Machine illustrated at the right. This production line mills, drills and bores Ford automatic transmission cases; inserts two bushings; automatically banks excess parts; transfers the casting from one station to the next. There are 26 stations, allocated as follows: 10 for machining, one for inserting bushings, one for banking, one for future engineering changes, and the remainder for other functions required in a modern transfer line. Several outstanding advantages are incorporated in this line, including unit construction and complete static electrical control. ¶Cincinnati builds special machine tools and complete production lines varying in complexity from small bearing-shell broaching machines to giant production lines performing a multitude of operations. Make Cincinnati your first choice for equipment of this type. The Special Machine Tool Division is ready to serve you.



Rough milling the pan face, station 2. This is the first machining operation on the transmission line.

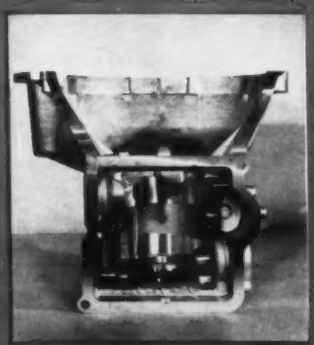


Boring and chamfering the large diameter. At the same time, boring and facing operations are performed from the other end. Station 8.

CINCINNATI®

Special Machine Tools · Vertical and Horizontal

Unit Type Transfer Line



Inside the transmission case. Hard-to-reach surfaces are easily machined on the CINCINNATI Transfer Line.

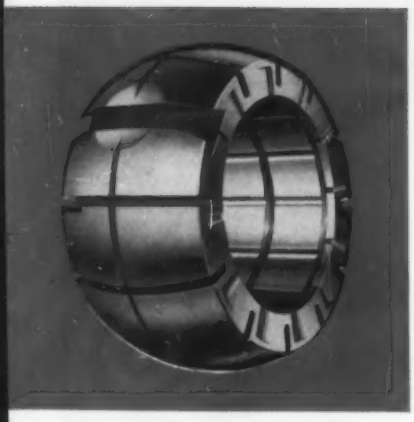
At Ford Motor Company's new plant in Sharonville, Ohio, automatic transmission cases are automatically bored, milled and drilled in 33 machining operations on this CINCINNATI 26-Station Transfer Line. Accuracy and finish are excellent. The machine cycles 137 times per hour.

CINCINNATI

Broaching Machines · Complete Production Lines

Special Machine Tool Division
THE CINCINNATI MILLING MACHINE CO.
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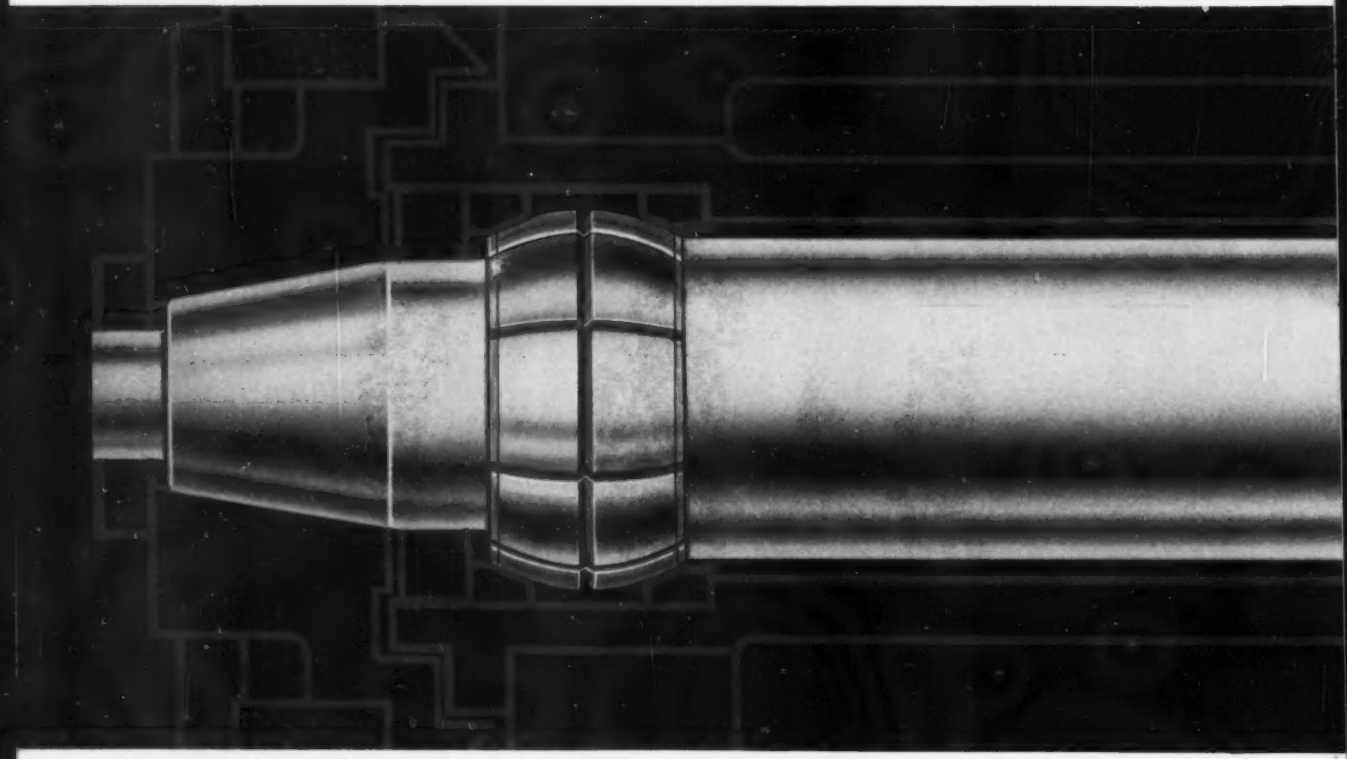
Microsphere bearings prove their on more than 15,000 Landis grinders



SAVES TIME . . . close running clearance gives quick positive spark-out and faster grinding cycles.

TROUBLE-FREE OPERATION . . . simple, one-piece bearing.

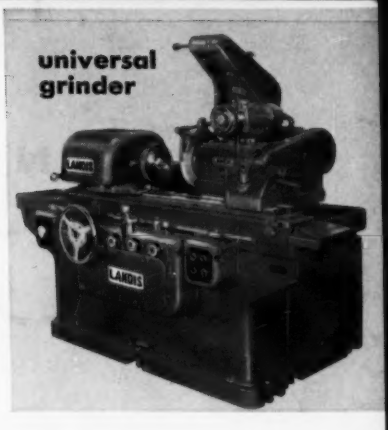
INCREASED STOCK REMOVAL . . . heavy duty rigidized spindle permits heavier cuts to precision tolerances and fine finishes.

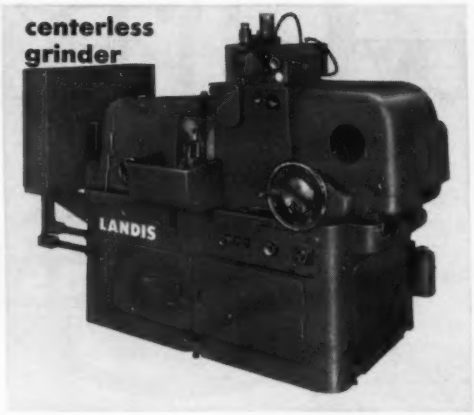


Cross section of a typical Landis rigidized wheel spindle and Microsphere bearings.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

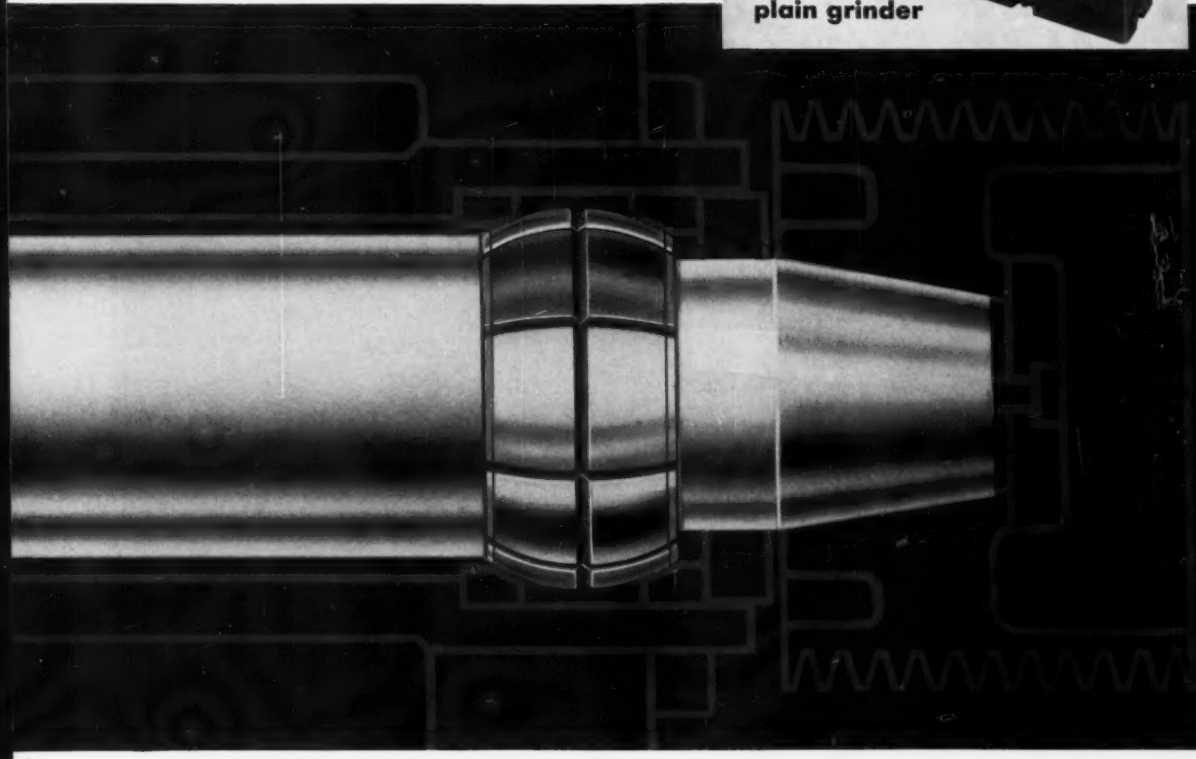
production advantages







Exclusive one-piece Microsphere bearings are used on all Landis plain, universal, centerless, roll and special purpose grinders.



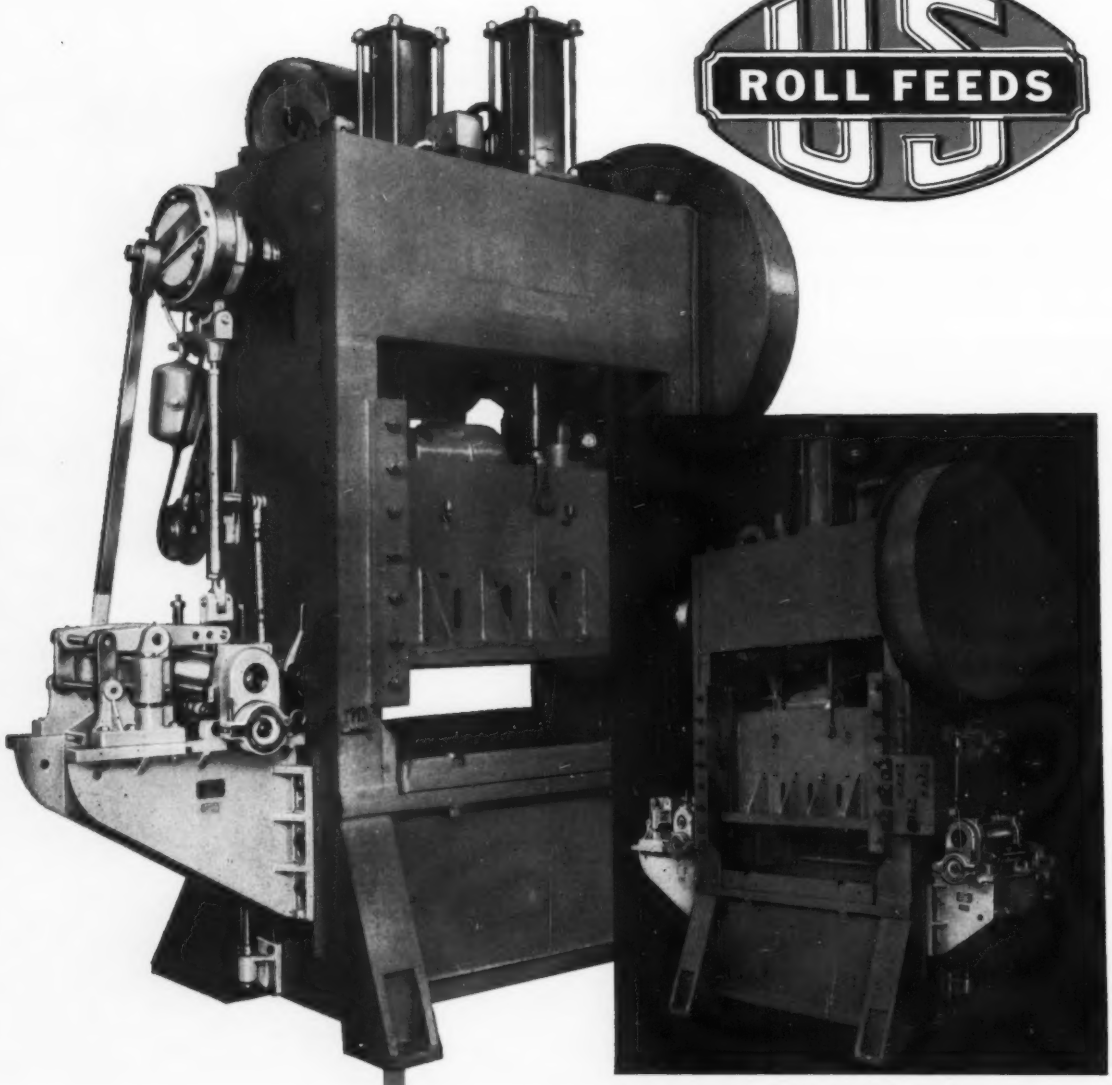
LANDIS

precision grinders

FOR CONSISTENT PERFORMANCE

U.S. Style "B"

ROLL FEEDS



U. S. Style "B" double Roll Feed Model No. RF-1212, with scrap chopper mounted on a modern straight side press. This particular installation handles stock widths up to 12", with feed length adaptable up to 12".

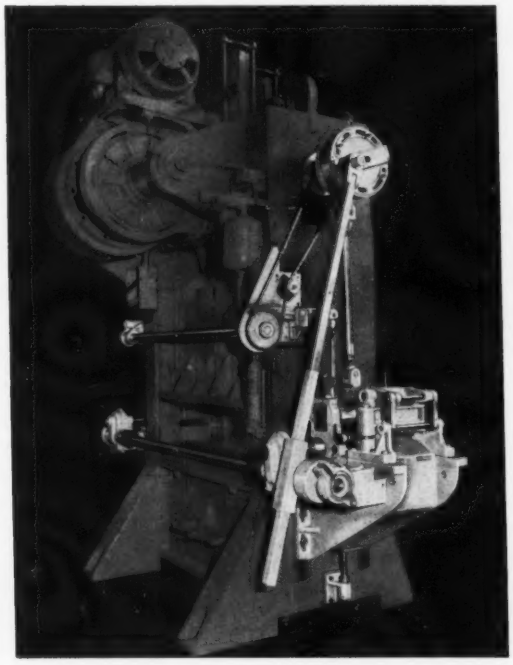
Roll Feeds

The introduction of U. S. Tool Company Style "B" Roll Feeds brings to your Press-Room a new line of Rack and Pinion Roll Feeds in a range of sizes to keep pace with most production requirements.

U. S. Style "B" Roll Feeds are made in both double and single types, with bolster plate for O.B.I. presses or with adjustable mounting brackets for straight side presses.

All Style "B" Roll Feeds are equipped with hardened and ground rolls of hollow construction, which are driven by hardened spiral gears running in oil. These gears are mounted in an enclosed housing. The roll-pin type over-running clutch has carbide inserts. Standard equipment also includes manual roll lifters; self-equalizing brakes; two-piece adjustable driving eccentric to simplify timing the feed in relation to the motion of the ram of the press; stock oiler and eccentric operated scrap chopper. Automatic roll lifters are available in either ram operated or adjustable eccentric operated types.

For full information regarding the U. S. Style "B" Roll Feeds write for your copy of Bulletin 85-M.



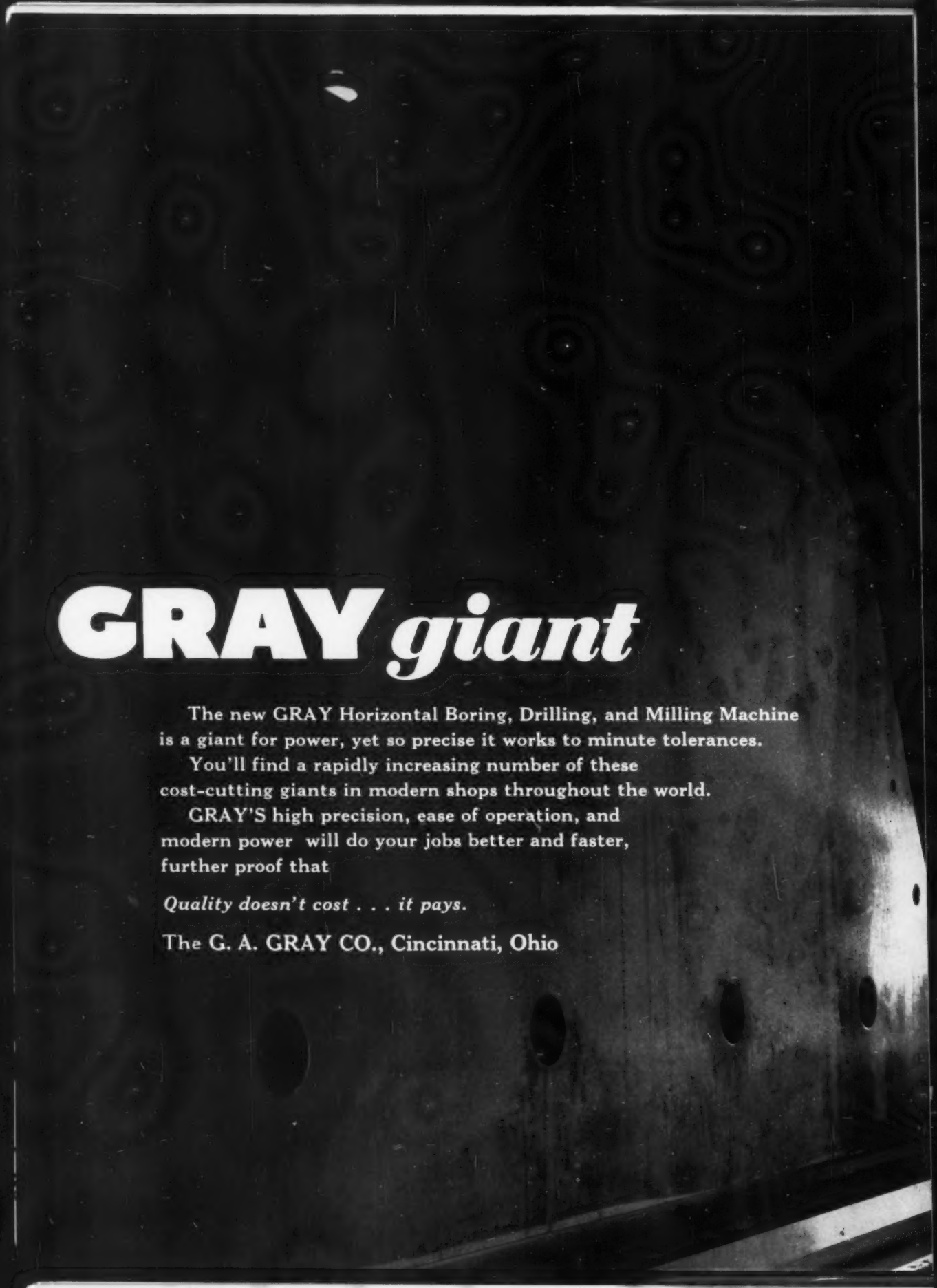
Rear View: Showing the rack and pinion mechanism and cross members for actuating the entering feed and eccentric operated roll lifters. One of 5 models of U. S. Style "B" Roll Feeds will fit your Press Room equipment.

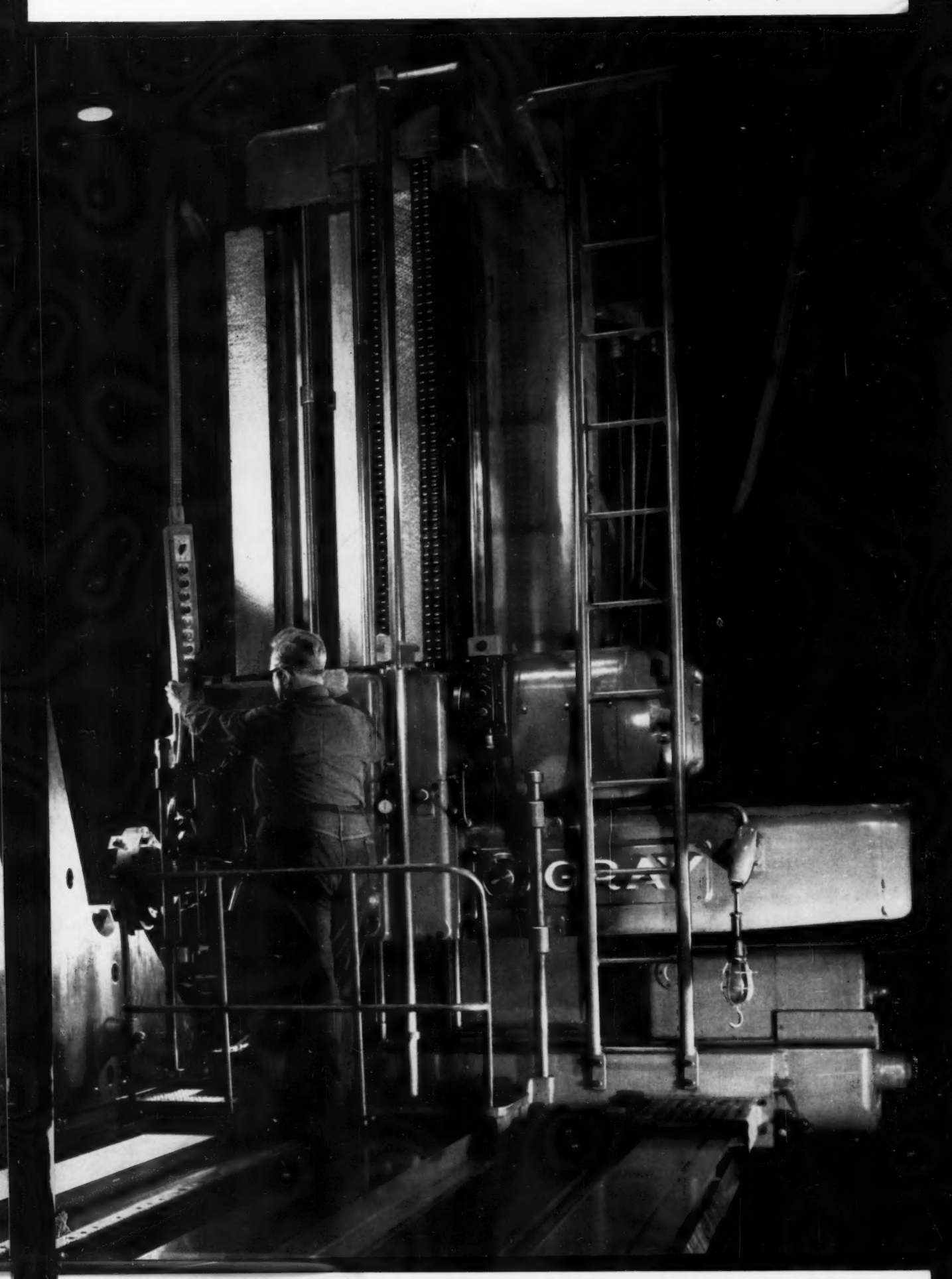
US PRODUCTS

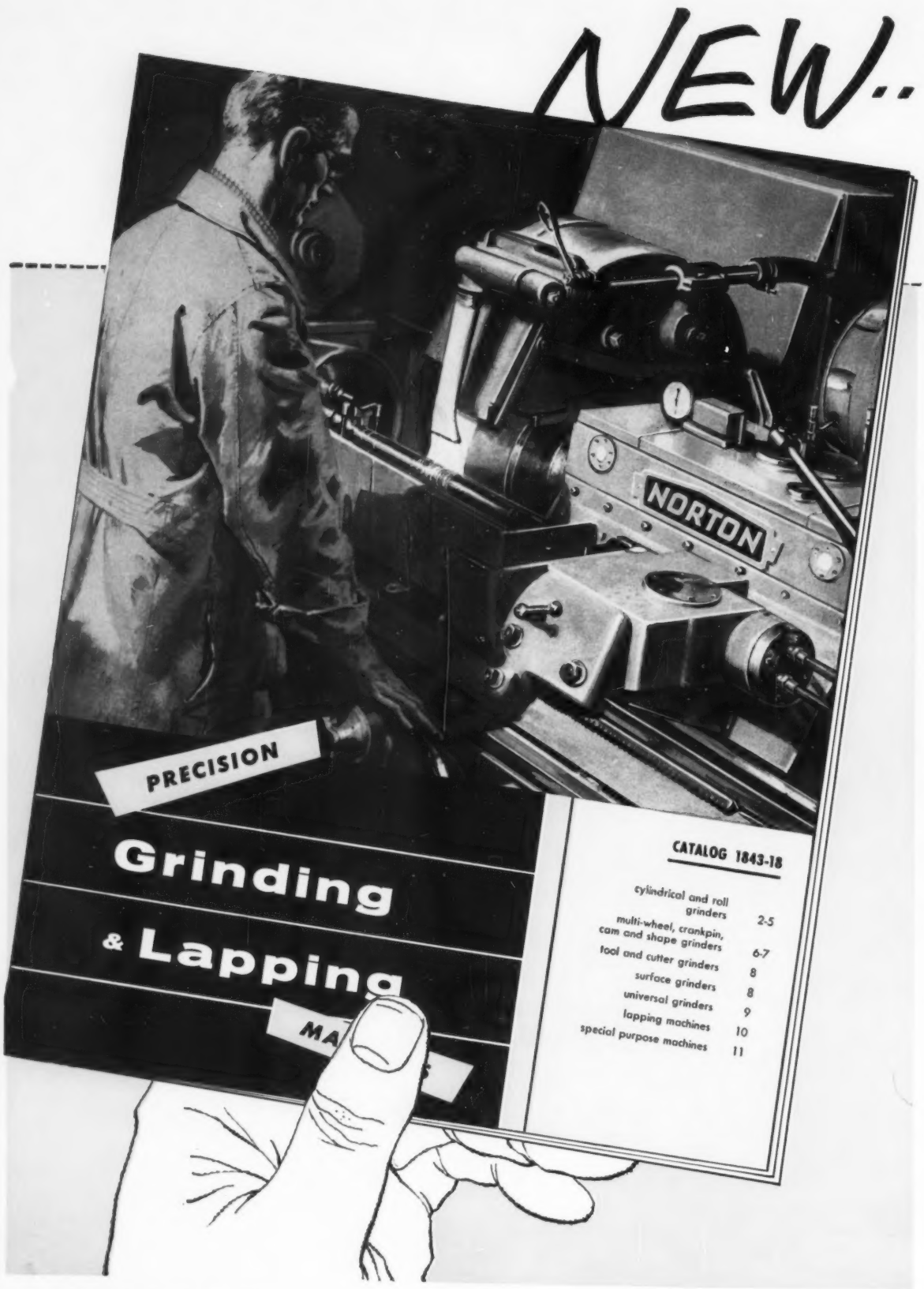
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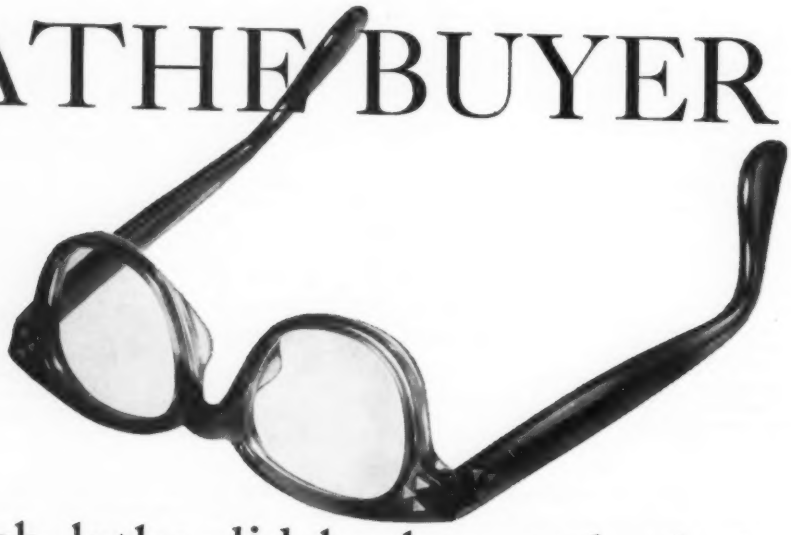
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The CASE OF THE DISCERNING LATHE BUYER



Which lathe did he buy and why?

Mr. Elwood Brandenburg,

Factory Superintendent of the Liberty Tool & Die Corporation, Rochester, N. Y., recently made a buying decision. His company, a well known manufacturer of precision tools, dies and special machines, needed a 16″ toolroom lathe for precision work. He wanted versatility, stamina, rigidity and operator convenience . . . and, like all of us, he wanted to make a good buy pricewise. Here's how he made his decision. Can you identify the machines?

The ones he rejected . . .



"Beautiful machine . . .
but too many gadgets I won't use.
Price too high."



"Same lathe as pre-War
No improvements.
Looks like our old machines."



"Only began making toolroom
lathes since the War. Had none
in the area to demonstrate."

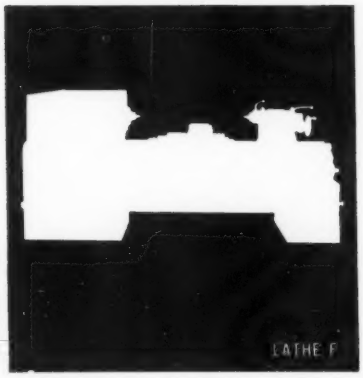


"Meets specifications,
but too light-weight and we felt
that low price was not the best value."



"These people only make a 16″ lathe now.
Can't help but wonder if they're
going out of the lathe business."

And the one he chose . . .



"All things considered, 4 points won me over:

1. "*Replaceable* hardened tool steel bedways . . . can't help but feel safer knowing if anything would happen to these basic precision components, they can be quickly replaced as good as new."

2. "Compensating veeway bed design . . . On some of my bigger machines the carriage always rides up off the ways when making a hogging cut. The compensating veeway design distributes forces so this can't happen."

3. "Two-speed tailstock . . . here's a feature that I can really use. It's especially useful for drilling and makes set-up easier, eliminates the bull work."

4. "New design headstock with compensating bearing enables us to use ceramic tooling."

"Those were the *facts* that swayed me over, but there was one other thing . . . call it an 'intangible.' The salesman. Lathe F's representative honestly acted as though he would like to sell me a machine. He was helpful as he could be. He took me to a nearby plant to see his machine in operation. Then, when I asked for the old hard sell . . . he had all the answers. Yes sir, the salesman *is* a factor."

for Mr. Brandenburg's decision, turn to page 294

LOOKING FOR MORE FROM

Trim steelcutting costs with Carboloy® Extra-Performance Grades 330, 350, and 370, and low-cost, General-Purpose Grades 78 and 78B

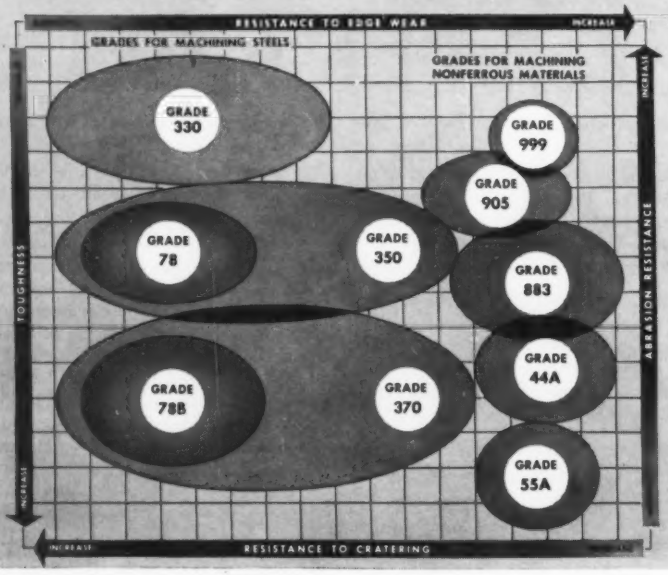
Some steelcutting jobs call for extra-tough, extra-performance carbides. Others can only be handled profitably with low-cost, general-purpose carbides. That's why we make them *both*.

Where you need increased machine productivity and have long production runs, to keep cost-per-piece low use Carboloy Extra-Performance Series 300 carbides. Their added strength and stamina handle jobs ranging from heavy roughing to high-speed finishing . . . at a cost and rate no "premium" carbide on the market can beat.

But, for general-purpose steelcutting jobs that don't require the Extra-Performance carbides, use Carboloy Grades 78 and 78B. Their top-notch performance, at low initial tool cost, will keep your machines operating profitably.

Chances are, your plant should be using *both* grades. Your local Authorized Distributor of Carboloy cemented carbides can deliver tools, blanks and inserts you need . . . in a hurry.

This complete team of Carboloy cemented carbides gives you more for your carbide tool dollar!





YOUR CARBIDE TOOL DOLLAR?



Cut nonferrous materials with low-cost Carboloy® Grades 44A and 883 . . . get longer tool life, increase production rates

These Carboloy cemented carbides are performance-matched to your cutting job for optimum machine productivity.

For interrupted cuts and tough production runs, use Carboloy Grade 44A. High shock resistance and good wear resistance make this a versatile grade for all machining jobs where a rugged carbide is needed.

When your job demands a carbide with built-in stamina and high wear resistance for general-purpose machining of nonferrous materials, use Carboloy Grade 883. You will get longer tool life and lowest cost-per-piece.

There are 5 Carboloy cemented carbides for cutting nonferrous materials, including Grades 44A and 883. One of these is designed especially for the particular characteristics of your cutting job to give maximum tool efficiency. Job-matched performance of these Carboloy nonferrous grades means better value for your cutting dollar.

To find out more about Carboloy Extra-Performance and General-Purpose carbides, or low-cost nonferrous grades, call or write: Metallurgical Products Department of General Electric Company, 11157 E. 8 Mile Boulevard, Detroit 32, Michigan.

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

Here are 6 good methods for making easy jobs out of hard ones



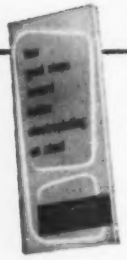
1. For precleaning in the plating shop

Oakite precleaners quickly remove the toughest soils that work their way into the plating shop. This 44-page illustrated booklet gives useful information about tank precleaning on pages 6 to 11 and machine precleaning on pages 11 to 14.

2. For descaling and derusting steel

Oakite Rustripper saves time by removing heat scale and rust in the same operation that removes oil. Alkaline pickling with Rustripper avoids hydrogen embrittlement, etching of machined surfaces and other disadvantages of acid pickling.





3. For electrocleaning steel

Oakite Composition No. 90 is a reverse-current cleaner with great ability to remove oils, smuts and other objectionable films that interfere with good electroplating. Solutions have high conductivity and long service life. Controlled foaming eliminates explosion hazards.



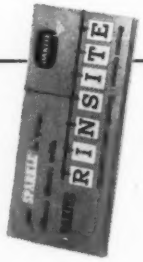
4. For electrocleaning brass

Oakite Composition No. 191 scientifically protects brass from the oxygen that tarnishes during the use of reverse current. Solutions have high conductivity, long life and high tolerance for chromic acid carried over by plating racks.



5. For electroconditioning zinc die castings

Oakite Composition No. 95 anodically removes all films that would impair the brightness of the plate. Under-surface shadows and anodic blackening are eliminated. A manufacturer of die-cast hardware reported "No. 95 cut our cleaning rejects more than 95%."



6. For preventing water spots

Oakite Rinsite causes rinse water to drain rapidly, leaving the plated metal bright, sparkling and completely free from water spots and tarnish. Rinsite is also good as a rust preventive in rinses between barrel finishing operations.

FREE

Write to Oakite Products, Inc., 26 Rector St., New York 6, N. Y., for the booklets (listed below) that interest you:

1. "Some good things to know about Metal Cleaning"
2. "Here's the best shortcut in the field of electroplating"
3. "Four good steps toward better electroplating on steel"
4. "What's NEW in electrocleaning brass and other copper alloys"
5. "Good news about electrocleaning zinc-base die castings"
6. "Put SPARKLE in your rinse water with Oakite Rinsite"

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
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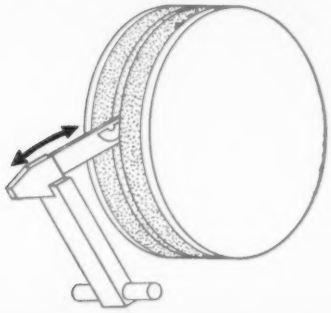
Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite



Gardner disc cuts costs of grinding cast iron cams

...shows highest production per disc in 3-way competition



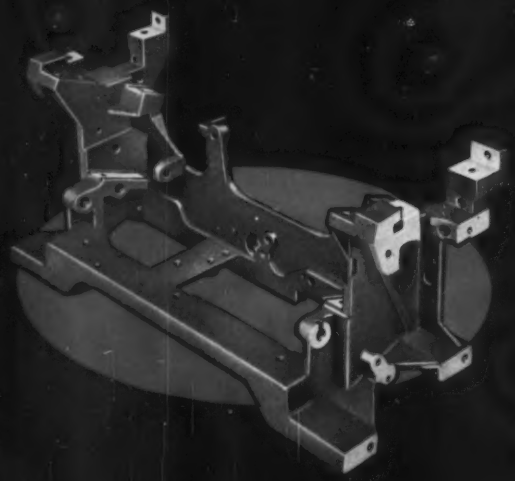
Production Test	
Disc "A"	5000
Disc "B"	6000
Gardner	7284
Workpiece	Cast Iron Cam
Operation	Grinding both sides of workpiece
Stock Removal	.045"—each side
Flatness	±.0015"
Parallelism	.001"
Uniformity	.001"

GARDNER

abrasive discs

BELOIT, WISCONSIN

Completely Machines Aluminum Typewriter Frames



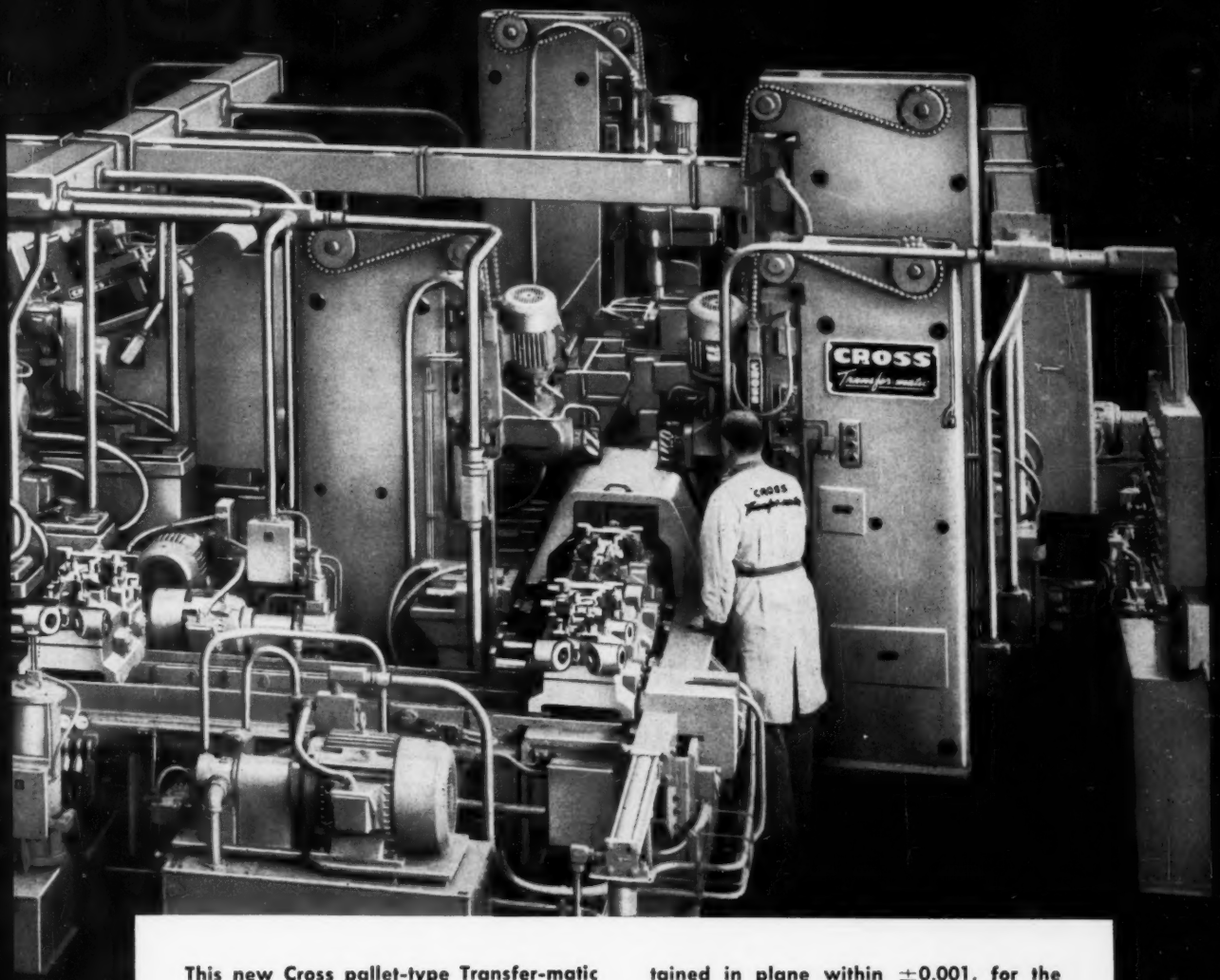
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Another Automation First by Cross



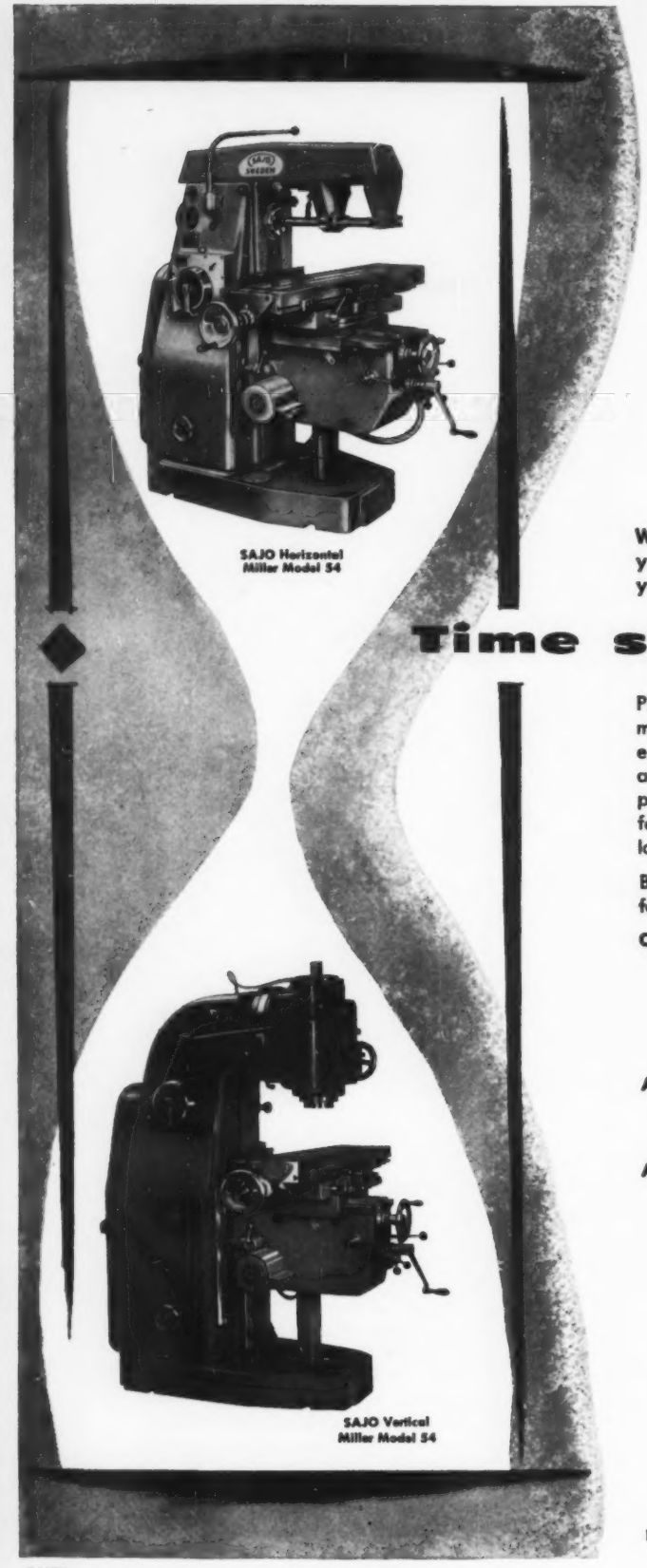
This new Cross pallet-type Transfer-matic completely machines aluminum die cast power frames for typewriters at a rated capacity of 150 per hour.

One hundred and five broaching, milling, drilling, reaming, spotfacing, chamfering and tapping operations are performed on each part. The delicate castings are precisely power clamped in pallet-type, two-position work holding fixtures, and transported through a loading station and eleven machining stations. Each part travels through the machine twice. On the first trip, the top, bottom and back side are exposed to the tools. On the second trip, the ends are exposed.

Tolerances for the rail seats are maintained in plane within ± 0.001, for the overall length within ± 0.003, for the shaft holes in line from end to end within ± 0.001, for the hole locations relative to milled surfaces within ± 0.003, and for the four broached spring seats in plane within ± 0.005.

A Cross Machine Control Unit with Toolometers programs tool changes to minimize down time. Standard Cross Tool Setting Fixtures are used to pre-set all tools, thus eliminating trial cuts and adjustments.

Other features are complete interchangeability of all standard and special parts for easy maintenance, construction to JIC Standards, hardened and ground ways and automatic lubrication.



SAJO Horizontal Miller Model 54

SAJO Vertical Miller Model 54

**We can't turn back the calendar, but—
you can buy SAJO Millers today at the same price you paid for a comparable machine tool in 1949.**

Time stood still...

Produced by Sweden's master craftsmen, these modern machine tools are engineered to maintain precise tolerances in continuous heavy-duty production. An example is the unique SAJO spindle construction employing SKF precision 2-row staggered roller bearings followed by thrust ball bearings, providing better load distribution and silent, vibration-free operation.

Built to U. S. standards, SAJO Millers are recognized for their accuracy, dependability and long life.

Condensed specifications:

table 52" x 11"
longitudinal movement 33½"
16 spindle speeds, 39-1500 r.p.m.
American Standard Taper No. 50
main drive motor 7½ h.p.
feed motor 1½ h.p.

Accessories:

Universal Dividing Head, Rotary Index Table, Vertical and Universal Milling Attachments, Slotting Attachment, Vises, Arbors.

Also available:

SAJO Plain and Universal Millers, table size 41½"x9¼".

Here are "hindsight" opportunities for foresighted machine tool buyers.

Write for literature and references in your area.

austin industrial corporation

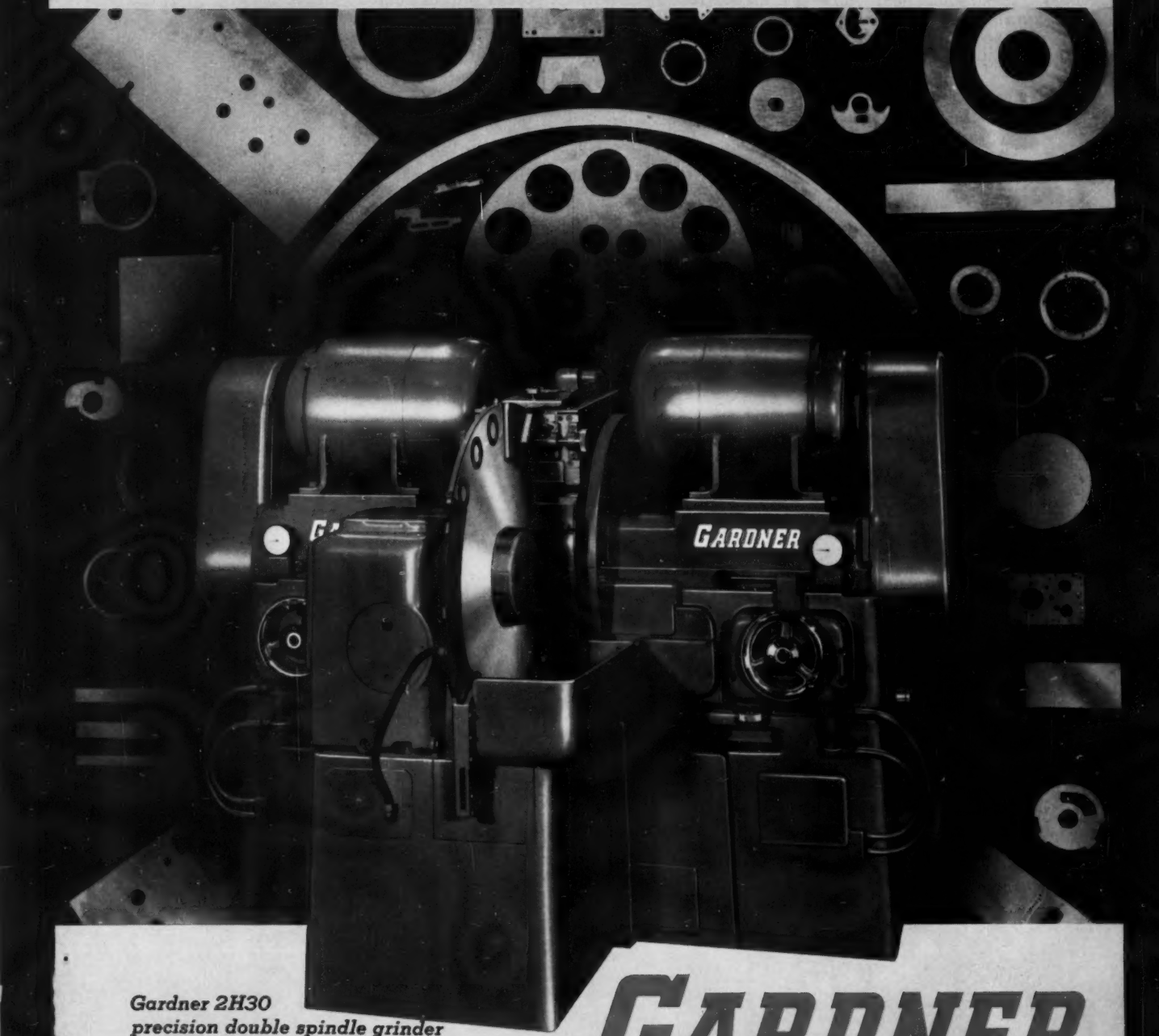
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HORIZONTAL AND VERTICAL SHAPERS—POWER HACKSAWS
Fast Service and Parts Available from Major Cities

2A158

versatility:

precision grind TWO parallel surfaces of widely varying parts in ONE operation



Gardner 2H30
precision double spindle grinder

Send prints of your parts for a Gardner proposal and request new general catalog.

GARDNER

precision disc grinders

BELOIT, WISCONSIN

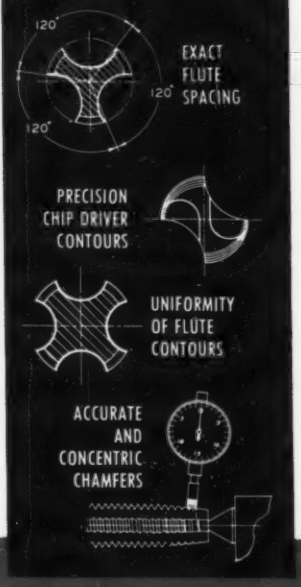
When the going is TOUGH . . .

Tapping Titanium and other tough metals proves the superiority of BALANCED ACTION

The skill and care that goes into every Winter precision tap is extended even further in taps designed for high tensile strength steels, titanium and other high-temperature alloys vital to aircraft and rocket construction. Special surface treatments and chamfers, engineered to the specific requirements of these materials, make possible greater accuracy, reduced friction, efficient chip disposal and long tap life.

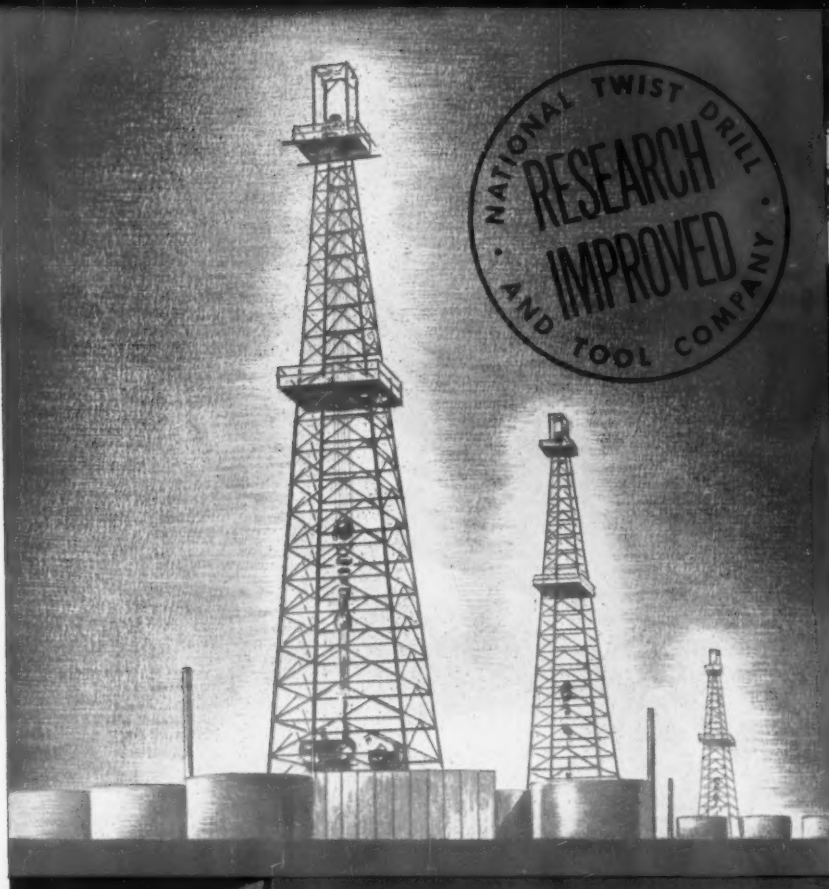
For taps, standard or special, insist on Winter Taps with Balanced Action—your guarantee of superior performance on all materials, all jobs.

CALL YOUR DISTRIBUTOR for standard and special WINTER Balanced Action Taps, Dies, and Gages.



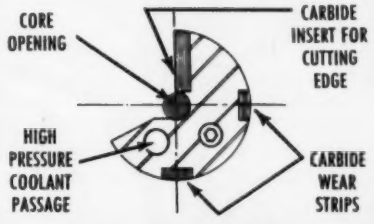


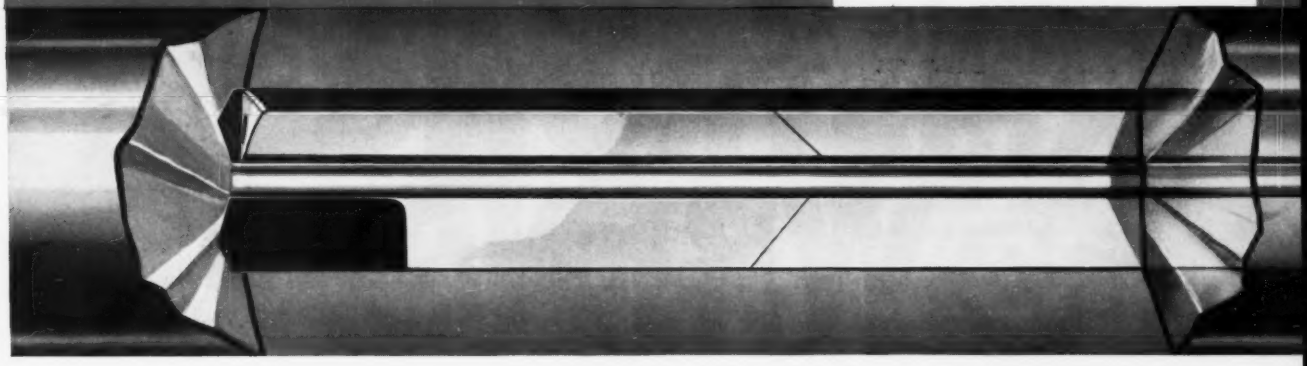
WINTER BROTHERS COMPANY, Rochester, Michigan, U.S.A.
Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas
San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.





The National Target Gun Drill above is 22 feet long, has no dead center, no zero speed area. Instead, it uses the solid core as a continuous center guide for the drill, producing a straight, true hole with good finish in a single operation.





ON TARGET . . . Research Improved Target Gun Drills give high accuracy even in holes 30 feet long

Only modern gun-drilling methods can meet the production demands of oil tool collars—long tubes made to bore miles under the surface of the earth. And National Target Gun Drills produce perfectly aligned holes through collar sections up to 30 feet long.

Target Gun Drills, ranging in size from ⅛" to 4" diameters, give new meaning to accuracy in drilling shallow or deep holes. And like all National quality tools, they are Research Improved—National's answer to the challenge of the newest materials, the hardest alloys, the toughest metal cutting jobs.



CALL YOUR DISTRIBUTOR for NATIONAL twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.



National

NATIONAL TWIST DRILL & TOOL — ROCHESTER, MICH. U.S.A.

NATIONAL TWIST DRILL AND TOOL COMPANY
Rochester, Michigan, U.S.A.

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Fine tools that encourage Good Work



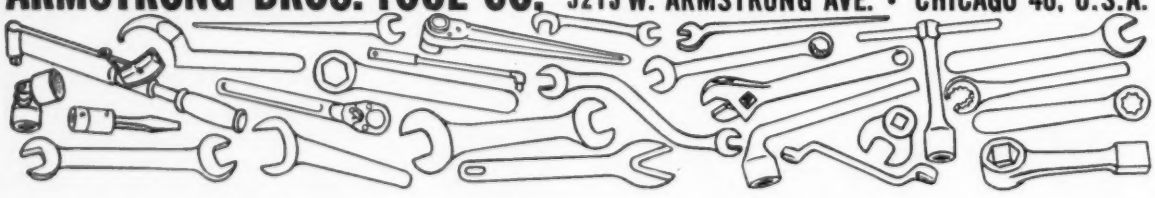
ARMSTRONG WRENCHES

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

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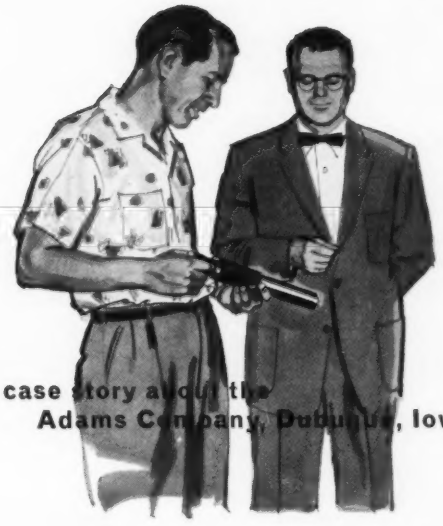
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Bob showed them a new product that ended rust on work and tools–

STANDARD Special Transparent Coolant



A case story about the Adams Company, Dubuque, Iowa

Before Standard Oil lubrication specialist Bob Wenger told The Adams Company management about Standard's SPECIAL TRANSPARENT COOLANT, there had been considerable trouble with rusting of work and machines in the plant. There had also been trouble with deposits on the ways of the grinding machines. Rust occurring on parts being processed was resulting in damage and even losses. This has been changed.

"Since we changed to your SPECIAL TRANSPARENT COOLANT, we have not had any rusting or deposits on our machine tools, and this product has eliminated the rusting problem on parts being processed through our plant," says Harlow Adams, president of the company.

The Adams Company found they received important additional benefits as well. Operators could now see their work clearly. There was less wheel loading. Because the coolant didn't foam, more of it stayed on the wheel resulting in cooler operation. Faster cuts were obtained with finer wheels. Finer wheels gave better finishes. Periods between dressings were extended. Tolerances were maintained.

Research, development and more than two years of field testing have gone into Standard's SPECIAL TRANSPARENT COOLANT. This is the pay-out to you on the research done by Standard Oil to bring you better metalworking products. Find out more about Standard's SPECIAL TRANSPARENT COOLANT. Call your nearby Standard Oil lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

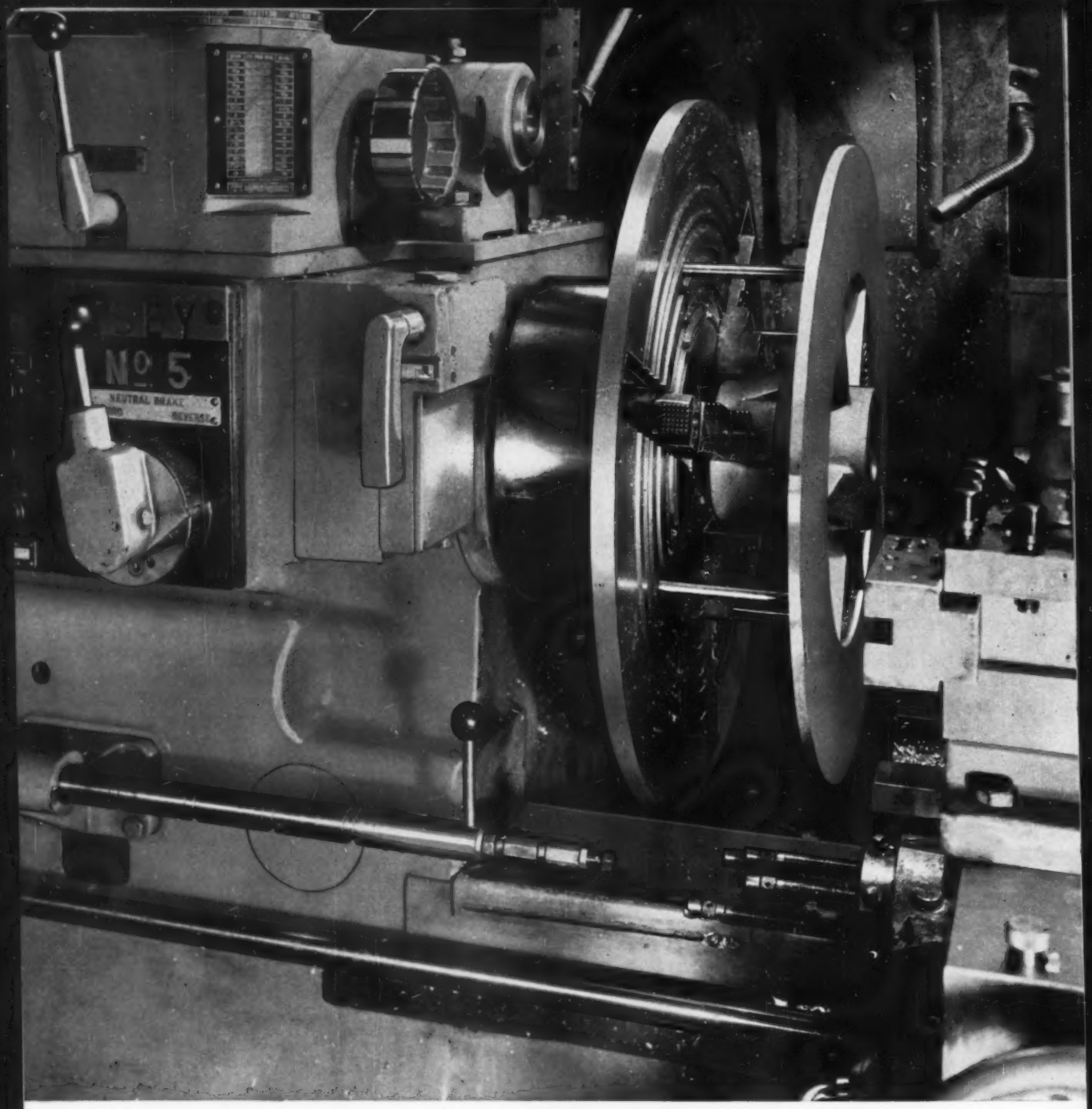
Quick facts about
Special Transparent Coolant

- Clear, transparent fluid.
- Able to control corrosion and rust on work and machines.
- All chemical. Does not support bacteria growth.
- Unaffected by humidity.
- Nonfoaming.
- Fire resistant.
- Odorless.



No rust. Shaft ground with Standard's SPECIAL TRANSPARENT COOLANT shows no rust on inspection by A.T. Murphy, General Superintendent, Harlow Adams, President, and Bob Wenger, Standard Oil lubrication specialist.

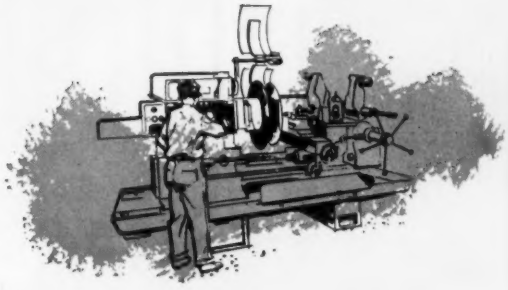
You expect more from STANDARD *and get it!*



Unique chucking arrangement in action

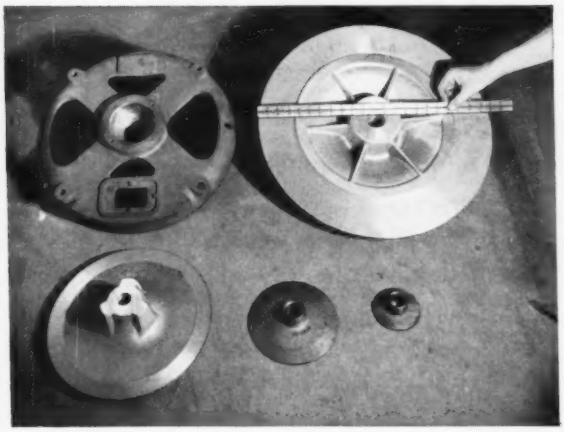
The versatility of Ilg's adjustable gap bed No. 5 Ram Type Turret Lathe is further increased by the use of a 12-inch air chuck and permanently-mounted face plate. Jaw slots in the face plate permit use of either standard or special top jaws. A series of tapped holes in the face plate allow clamping or back-stopping a range of large diameter parts, such as this 22-inch diameter cast aluminum fan hub. In addition, seven concentric grooves in the face plate accurately locate, on the rabbet diameter, various sizes of motor end bells for second operation machining of their bearing bores. This unique, time-saving chucking arrangement eliminated three face plate fixtures, drastically reduced setup time on lot sizes of 25 to 30 pieces, and permitted efficient handling of chucking work from 4 to 24 inches in diameter.

At Ilg Electric Ventilating Company...
Chicago, Illinois



Sliding gap bed extends chucking swing to 30 inches on Warner & Swasey No. 5 Ram Type Turret Lathe

Handling large swing parts now poses no problem. On smaller diameter chucking jobs, the gap can easily be closed—permitting the cross slide to work in close as on a conventional No. 5 Turret Lathe.



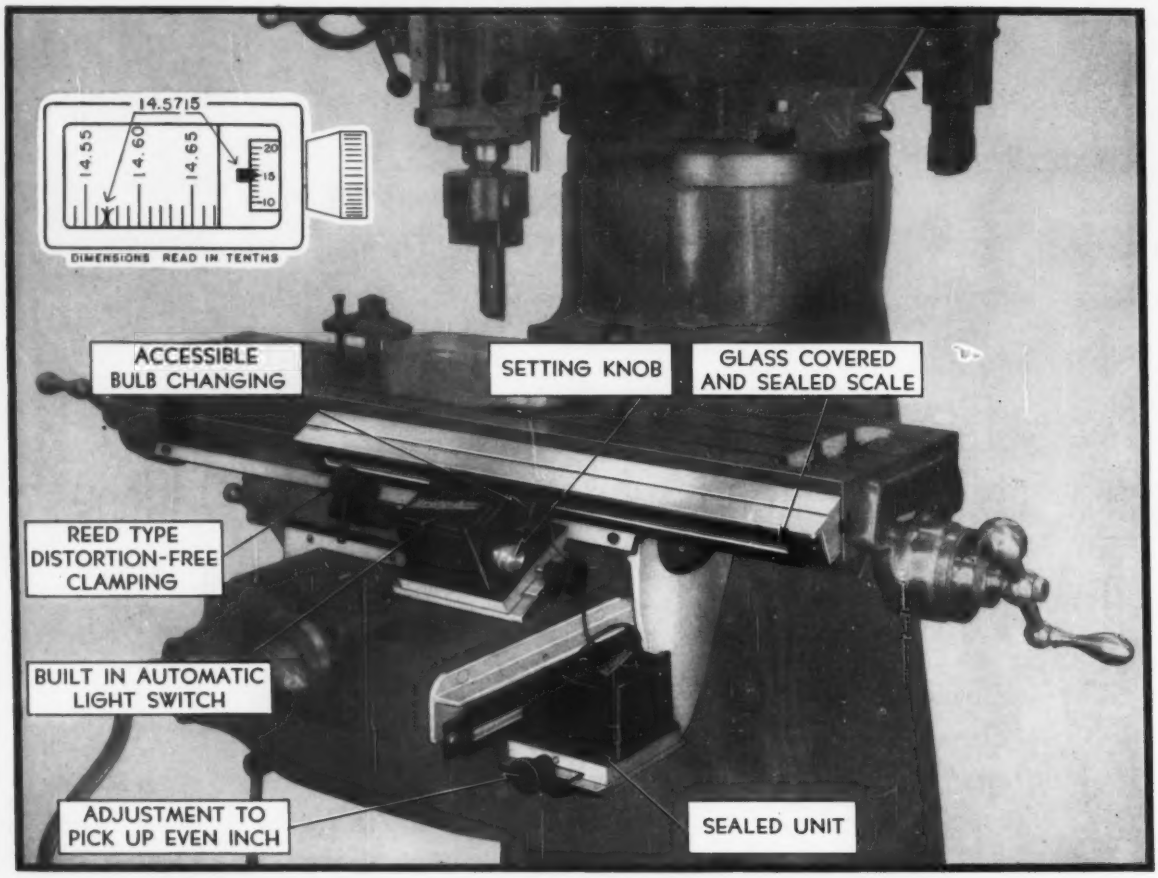
This leading producer of industrial heating and ventilating equipment had a replacement problem. In order to maintain their usual high standard of quality without increasing their costs, Ilg had to replace an older saddle type turret lathe that had been handling workpieces up to 24 inches in diameter. Lot sizes averaged 25 to 30 pieces. A new saddle-type lathe appeared to be the answer. However, all the other job factors—length of workpieces, metal removal capacity ($\frac{1}{8}$ to $\frac{3}{16}$-inch), and horsepower requirements—indicated the need for a smaller capacity, faster handling ram type machine.

Investigation revealed that a new Warner & Swasey No. 5 Ram Type Turret Lathe, with a sliding gap bed, would handle their type of production most economically.

After installation, Ilg Electric reports, "the machine's accuracy and rigidity easily hold our close tolerances (±.001 on rabbet diameter of motor end bells and .0005 in bearing bores). Further, it gave us higher speeds and instantaneous shifting for greater cutting efficiency in our work materials (aluminum, cast iron and steel). Overall machine handling time and operator effort were also reduced. Production increased as much as 65% on some parts."

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

You can produce it better, faster, for less... with a Warner & Swasey



The New Bridgeport OPTICAL SYSTEM

. . . fast, accurate and efficient

By using the NEW BRIDGEPORT Optical System it is now possible to read a figure on the scale as it appears on the working drawing. It is not necessary to add any figures or make any vernier estimations. The operator's skill in reading a single line is all that is required.

The new BRIDGEPORT Optical System is an accurate and time-saving method for quick positioning of table in both planes.

The Optical System is installed at factory on new machines and is easily installed in the field on any BRIDGEPORT MILLER already in service.

Further facts are available through your nearest dealer or through us direct.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

HOW THE TIMKEN COMPANY SAVES OVER 20% ON 220 PARTS

Bearing races machined faster and simpler with JETracer on No. 24's

You've got it made when you can machine 220 different parts on an *automatic* lathe with minimum change-over and tooling investment. This setup at The Timken Roller Bearing Company's Canton, Ohio, plant is really impressive.

Here are some of the production advantages gained by the installation of two Gisholt MASTERLINE No. 24 Automatic Production Lathes, with JETracer-controlled rear independent slides:

Increased production—Time is cut better than 20%. Here's the machining sequence on a typical, 11⅜″-diameter, 4$\frac{13}{32}$″-wide steel bearing race forging. For the first operation, location is at P and jaws hold on the middle of the body at D. The JETracer rough-contour-bores K-L-M. At the same time, the front independent slide feeds longitudinally to chamfer G and then cross-feeds to face H and chamfer J. The JETracer finish-bores K-L-M, completing the operation in 4.30 minutes floor-to-floor time. The part is held on a spring-loaded plug in taper K for the second operation. Location is against H and a drawback fixture clamps in taper M. The JETracer roughs B-C-D-E-F, while front independent slide tools feed longitudinally to chamfer N and then cross-feed to face P, form radii A-G and form-turn D. The JETracer then finishes surfaces B-C-E-F. Time is only 3.50 minutes f.t.f.

Added capacity—LESS FLOOR SPACE—Two machines handle parts ranging from 10⅝″ to 32″ diameter, 2″ to 9″ wide, and replace several other machines formerly required to do the same job.

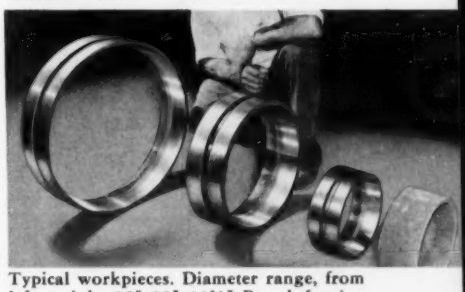
Versatility—Two machines handle first and second machining operations on approximately 220 different parts. Tooling costs are minimized by JETracer-controlled rear independent slides. Each has four-position indexing template carrier for one to four passes at the work during the automatic cycle. JETracer generates front and back angles up to 31 degrees, and carries a roughing and a finishing tool. On the final cut, the finishing tool automatically indexes into position for greater accuracy and a smoother finished surface. Feed rate of the JETracer slide is automatically varied to give uniform cutting speed on all surfaces for longer tool life and finer finish.

Quick change-over—All tracing templates are made to fixed length dimensions and locate against dead stops to eliminate adjustment. Swivel chuck jaws with inserts compensate for changes in part length. Four sets adjust to cover entire range of work. Tool holders and insert-type tool blocks are used to permit sharpening and presetting in the toolroom to eliminate chance of operator error and minimize machine down time.

Add the preceding to the EASE with which the No. 24 can be set up, adjusted and operated, and you have a work-, time- and cost-saving combination that's hard to beat.



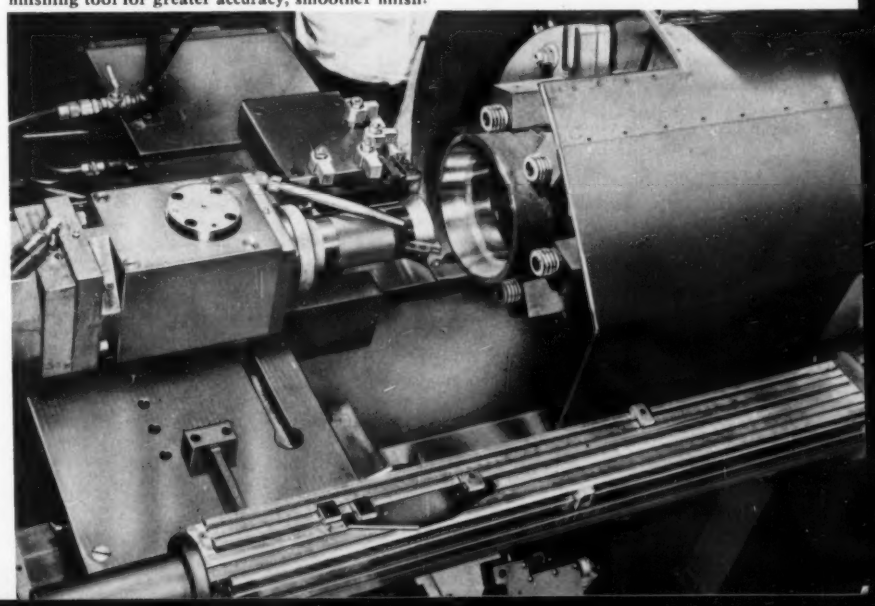
A new catalog on the No. 12 and No. 24 Automatic Production Lathes illustrates features, accessories and typical jobs. Ask for Bulletin 1213.



Typical workpieces. Diameter range, from left to right: 25″, 18″, 11⅜″. Rough forging at far right shows amount of stock removal required in the two fast, automatic operations.



Rear overhead view of first-operation tooling. Note four-position indexing template carrier in foreground. Tracer boring bar generates front and back angles and carries a roughing and a finishing tool for greater accuracy, smoother finish.



HOW DAIMLER-BENZ SAVES ON THIS JOB

Combined cuts, multiple tooling improve accuracy ...increase output

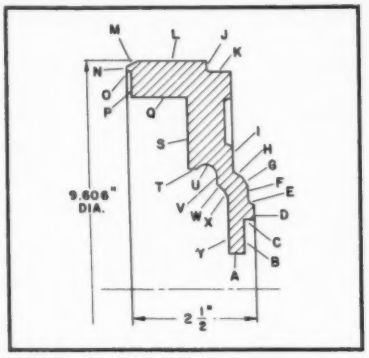
For fast, automatic machining of flywheels or similar parts, this setup at the Daimler-Benz plant in Mannheim, Germany, will give you some cost-cutting answers. Two Gisholt MASTERLINE Simplimatics are used. Tooling is planned for fast, easy change-over between different part sizes. One operator handles both machines. Here's how a typical, 9½"-diameter, 2½"-wide part is machined:

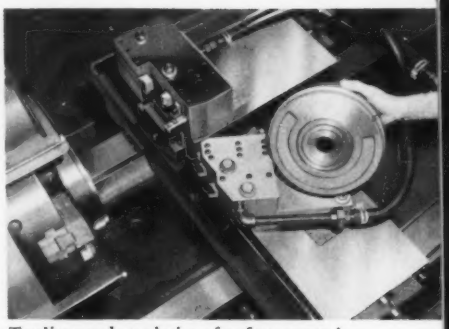
Operation 10—The workpiece is chucked in the co-bore Q, locating against a back-face S. Tools on the front independent slide face D-F-I-J and shave K. At the same time, tools on the rear independent slide finish turn K, finish face J, form radii at H and E, bore C, shave face B, rough and finish bore A and chamfer G. Nine different tools are used to machine 11 surfaces in only 2.5 min. f.t.f. time.

Operation 20—The workpiece is then placed in the second Simplimatic, locating against face I and chucking at K. Front slide tools face N-P-S-V-Y and form U, while rear slide tools turn L, form M-W-X and bore O-Q-T. Ten tools are used to machine 12 surfaces in only 2.1 min. f.t.f. time.

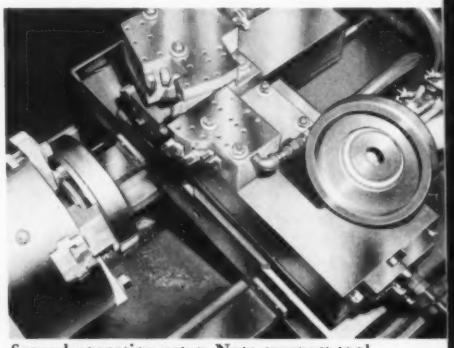
Simplimatic's wide platen table permits placement of slides and tools in proper relation to work, and permits machining greater number of surfaces in one chucking. Multiple cuts combine with automatic cycle to improve accuracy, save time and lower costs. Basic flexibility simplifies toughest jobs...often saves costs of special machine.







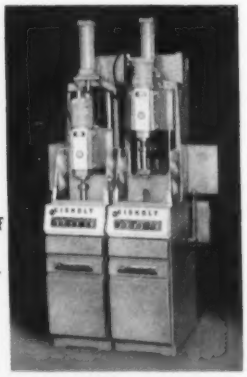
Tooling and workpiece for first operation. Rigid tool mounting provides fine finish in spite of severe, interrupted facing cut.



Second-operation setup. Note compact tool arrangement, possible only through Simplimatic's flat platen table permitting maximum tooling flexibility for all types of work.

SETUP DOUBLES PRODUCTION ON AUTOMATIC TRANSMISSION PARTS

Two-spindle Superfinisher delivers 240 parts per hour

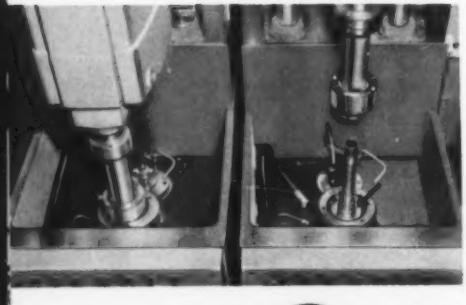


General view of the two-spindle Model 81 Superfinisher setup.

Perhaps a setup like this can pay you a profit, too. It features the Gisholt MASTERLINE Model 81 Vertical Superfinisher, designed to produce a "controlled" surface finish on flat, conical or spherical surfaces at high production rates. The vertical design requires minimum floor space and permits easy addition to existing production lines. Here is how it is used on automatic transmission hub and turbine shafts at a well-known automotive manufacturer's plant.

The operator places the 5¼"-diameter, 9"-long part in a fixture, centralizing and driving in the large bore, with the shaft extending upwards towards the Superfinishing head. He presses the cycle start button and the upper stone-carrying head descends. The quill is hollow and goes over the shaft so that the cup-type Superfinishing stone can engage the seal surface on the clutch hub. In just a few seconds the precision-faced surface is reduced from 80 to the desired 20 micro-inch RMS finish. At the end of the automatic cycle the quill raises to clear for unloading. Floor-to-floor time is only 25 seconds.

This two-spindle Model 81 is easily handled by one operator. While one spindle is in use, the operator is unloading and inserting a new part on the other. Superfinish is faster than methods previously used, and "tandem" setup gives total production of 240 parts per hour at 80% efficiency.



Superfinish quill (hollow) moves over shaft at left unit to engage cup-type stone with seal surface. Quill is retracted at right unit for unloading. Superfinished seal face is indicated by arrow.

Simple, compact setup requires minimum floor space; doubles operator productivity; exposes true base metal on important seal surface for long, trouble-free operation. Superfinish provides any desired surface finish in less time and at lower cost.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

SMART SETUP IMPROVES ACCURACY ON MULTIPLE BORE JOB

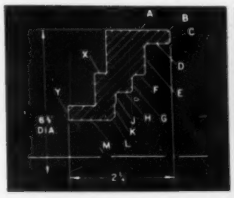
Hi-Lo feature on Speed Selector saves additional time

MASTERLINE GISHOLT SINCE 1887

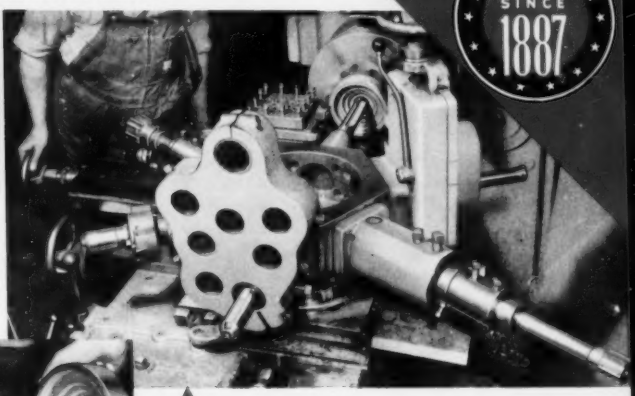
You may get an idea from this typical job-shop setup on a Gisholt MASTERLINE 2L Saddle Type Turret Lathe. It shows how to achieve accuracy, smooth finish, parallelism and concentricity on multiple boring operations, at low cost.

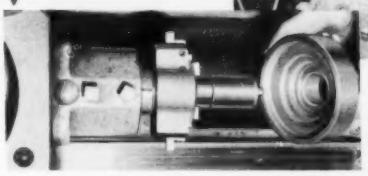
The Gisholt Hydraulic Speed Selector is an important factor in achieving a quality finish and maximum tool life on this job. Offering a choice of DIRECT or PRE-SET operation, the operator selects correct spindle speeds by simply aligning work diameters with the Hi-Lo Lever on the Selector Handwheel. In DIRECT operation, speed changes are actuated by turning the handwheel to a new setting. In PRE-SET operation, the next speed is selected during a cut and when needed, is obtained by a touch on the Hi-Lo Lever. In either case, the speed shift is completed without any further attention from the operator while he positions his tools for the next cut. The Hi-Lo Lever may also be used to provide an instant speed change in a ratio of 6:1, without moving the selector handwheel. For this setup the Speed Selector is operated DIRECT.





Close-up of part and spade cutter on hex 5 used to simultaneously finish co-bores D-F-H and shave faces C-E-G-J. Note smooth finish obtained.





Simple tooling setup for reverse clutch housing. Note fully tooled hex turret...with multiple turning head and adjustable slide tool in place, providing flexibility for quick setup on other jobs.

The workpiece, a cast semi-steel reverse clutch housing, is located against back face Y and chucked on previously turned diameter X in a 3 jaw scroll chuck. A is rough turned from the square turret while M is drilled from hex 1. Other square turret tools rough face C, rough co-bores D-F-H and relief K. M is semi-finished from hex 2. The operator taps the Speed Selector Hi-Lo Lever for an instant, 6:1 speed change, and reams bore M from hex 3. He raises the lever to return to the previous speed and chamfers L from hex 4. Next, a high speed steel spade cutter on hex 5 simultaneously finish co-bores D-F-H and finish shave faces C-E-G-J. He uses the Hi-Lo Lever again to ream H from hex 6 and rotates the selector to a new speed to finish turn A, chamfer B and break the sharp edges on the co-bores from the square turret. Floor to floor time ...16 minutes.

Spade cutter handles 3 co-bores, 4 faces in one pass to assure accuracy. Hi-Lo feature on Speed Selector automatically provides proper speeds when going from drilling, turning or boring, to threading, forming or reaming.

MACHINE SPECIALTIES AUTOMATES RAM TYPE LATHE...SAVES 25%

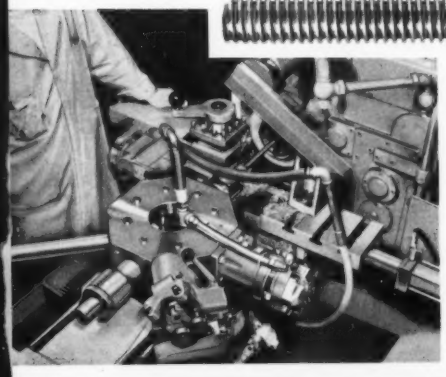
Hydraulic drive takes over, frees operator for other work

If you're doing job-lot or contract work, you can profit from this setup at Machine Specialties, Chicago, Ill. It'll show you how to cut tooling costs, increase production and beat the "profit squeeze" through automatic operation of hand-operated machines.

Here are a few of the advantages offered by specifying hydraulic drive operation for your new ram type turret lathes: consistent, automatic cycle permits accurate time estimates for accurate, competitive bidding; proper speeds and feeds are automatically selected and offer uniform quality, longer tool life; the operator has plenty of time to handle additional units or perform other work.

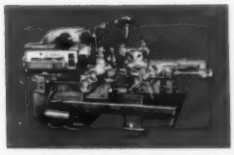
Here is how it works on ⅝" Acme adjusting screws, machined from leaded screw machine bar stock in lots ranging from 500 to 2500 pieces. The machine is a Gisholt MASTERLINE No. 5 Ram Type Turret Lathe. The hydraulic drive controls operation of the turret and the cross slide and all machine functions, including feeding of the bar stock and opening and closing of the collet chuck.

During each automatic cycle the stock is fed to a turret stop and chucked. The end is chamfered to provide an accurate thread start and a die head machines a Class 3 thread. Ample coolant is provided by the turret coolant distributor. Speed is changed and the die head recocked on an angle iron cam mounted in place of the overhead pilot. With support from the turret, the end closest to the spindle is formed from the front cross slide. A hollow tube on the final turret station catches the part as it is cut off from the rear cross slide. The cycle repeats automatically until new bar stock is needed.





Overhead view of tooling setup required to produce ⅝" Acme adjusting screw. Automatic cycle operation of ram type turret lathe eliminates chance of human error, assures greater uniformity and accuracy, piece after piece. (Inset) 7½"-long, ⅝" adjusting screw.



Floor-to-floor time on the 7½"-long, ⅝" Acme adjusting screw shown is only 1.6 minutes. Operator removes finished part from catcher and keeps replacing bar stock as required. Has plenty of time to handle additional machines or perform other work.

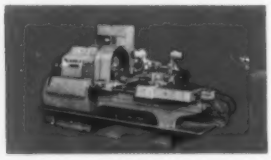
MASTERLINE
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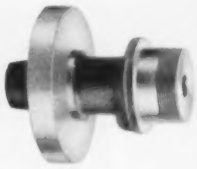
MINNEAPOLIS-HONEYWELL SAVES ON VALVE BONNETS

Smart setup includes threading on automatic turret lathe

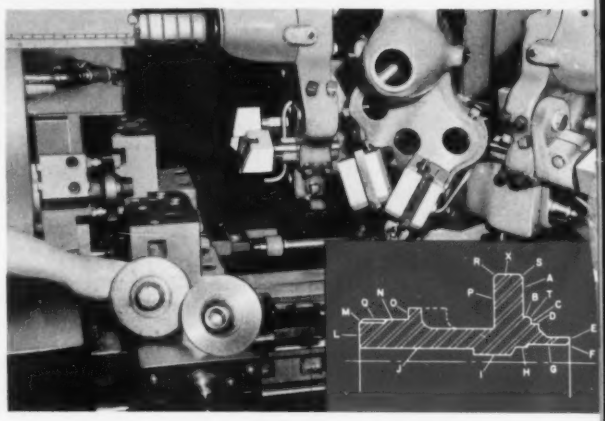
Here's a setup that improves quality and substantially reduces machining costs on three different sizes of steel valve bonnet forgings at Minneapolis-Honeywell's Fort Washington, Pa., plant. It's done with a Gisholt MASTERLINE 1F Fastermatic Automatic Turret Lathe with a lead screw threading attachment.

Each part is machined in two operations. Smooth hydraulic feed helps achieve a 63 micro-inch finish in the bores at both ends. First operation is on the large flange end of the 5⅜"-high, 4¾"-dia. part. Sequence: chuck on N, locate at P; Hex 1—start drill H, and at the same time face C-E and form D from front cross slide; Hex 2—rough turn X, drill H while rear cross-slide tools face A, shave B; Hex 3—finish turn D-X, rough bore G, chamfer F; Hex 4—chamfer S-T; Hex 5—finish bore G. Time, 2.5 min. f.t.f.





Close-up of tooling for first operation. Note multiple tooling wherever possible to cut time, improve parallelism and concentricity. Rough and first-operation part at left front indicates metal removed. (Above) Finished part showing surfaces machined.



Second operation—Chuck at X, locate at A; Hex 1—start drill J; Hex 2—rough drill J, rough turn N, chamfer R while P is faced from rear cross slide; Hex 3—idle but L-O is faced from front cross slide; Hex 4—drill hole I and flat bottom J, chamfer M, finish turn N; Hex 5—finish end-mill J; Hex 6—thread Q. F.t.f. time, only 5.5 minutes.

Fastermatic's automatic cycle maintains accuracy while automatic selection of proper feeds and speeds prolongs tool life. Threading attachment assures accurate leads and Class 3 threads.

HOW TRANE COMPANY PRE-PLANS...CUTS BALANCING COSTS

This ingenious setup handles a variety of parts

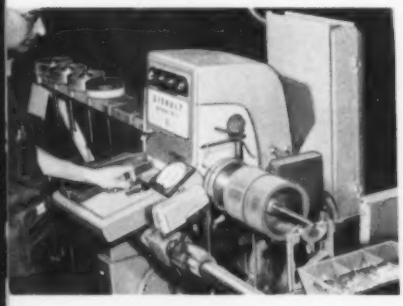
This idea from the Trane Company of La Crosse, Wisconsin, pays big dividends by combining balancing operations for a number of different parts on one machine.

Here a 1S Balancer is set up to balance six different sizes of single- and double-width centrifugal fan wheels for Trane's well-known line of air-conditioning, heating and ventilating equipment. Fan lengths range from 2⅝" to 13⅝"; diameters from 4" to 12", and weights from 1¾ to 21 lb.

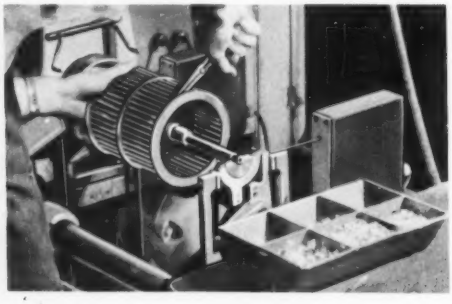
Arbors are used to support, locate and drive. Various sizes of arbors, with angularly graduated pulleys, identified by workpiece numbers, are racked beside the balancer. A simple reference card file guides operator to arbor selection and machine calibration for each part.

Here's a typical operation on an 11-pound, 7" DWDI centrifugal fan wheel. Fan is mounted on correct arbor, placed between work supports, and belt drive applied to the pulley O.D. Operator notes angle and amount of unbalance in two correction planes, and stops part. Then, indexing work to the indicated angles in each correction plane, he matches the observed amount meter readings with the same weight metal clips. The clips are crimped in place on the fan blades to correct unbalance. Part is rotated again to inspect and the operation is complete—in only 1 minute f.t.f.

Switch levers for both left and right correction planes give simultaneous indication of angle and amount of unbalance. Note handy arbor rack at left and tray of correction weights at right.



Operator crimps correction weight clip into place on fan wheel blade. Angularly graduated pulley on keyed driving arbor simplifies location of exact unbalance angle in each correction plane.



Costs are cut by measuring, locating, correcting and inspecting for unbalance in single handling. Pre-planned setup speeds change-over, permits balancing wide variety of parts at top efficiency.



713
No. 9-1058

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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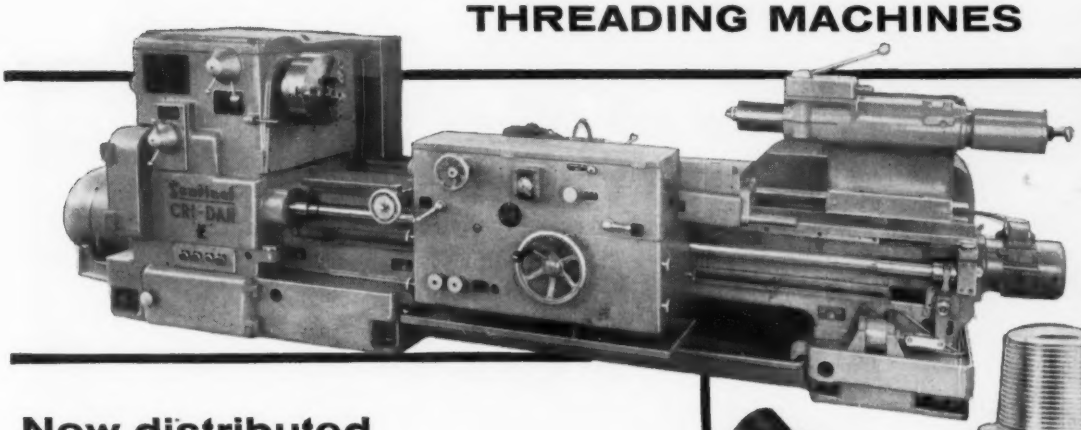
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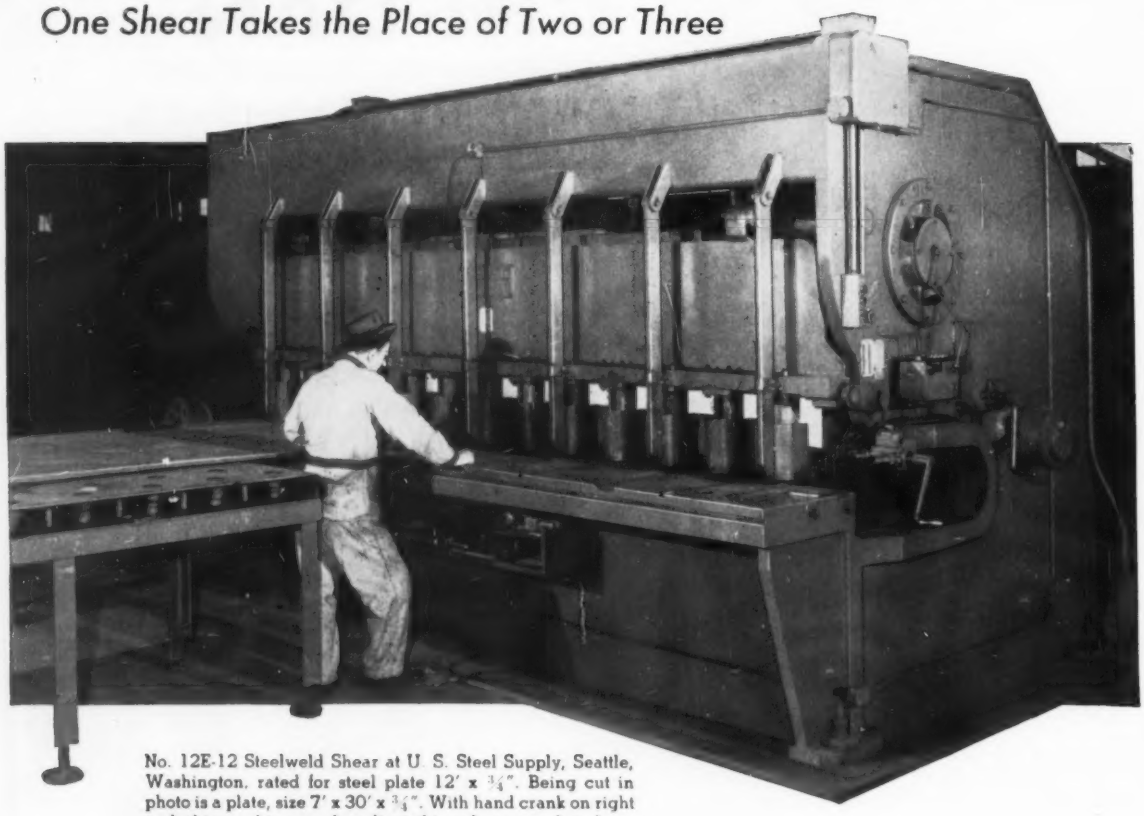
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No. 12E-12 Steelweld Shear at U. S. Steel Supply, Seattle, Washington, rated for steel plate 12′ x ¾″. Being cut in photo is a plate, size 7′ x 30′ x ¾″. With hand crank on right end, this machine can be adjusted in a few seconds to have exactly the right knife clearance to obtain the finest cut for any thickness. To make this adjustment on guillotine-type shears usually requires several hours.

MANY steel warehouses have two and often three shears, one of a ¼″ capacity for lighter thicknesses, another of ½″ capacity for cutting ¼″ to ½″ material, and a third with 1″ capacity for thicknesses over ½″ and up to 1″. At some of its warehouses, U. S. Steel Supply uses only one machine for cutting the various thicknesses—a Steelweld Pivoted-Blade Shear.

One machine takes the place of two or three, because it is so easy to adjust the knife clearance required to obtain the best cuts for different thicknesses, which can range from lightest gauge metal to the heaviest plate within the capacity of the shear.

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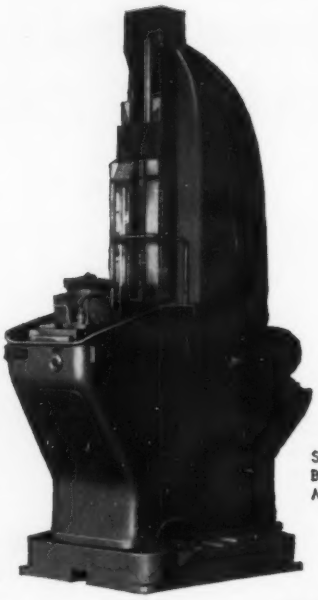
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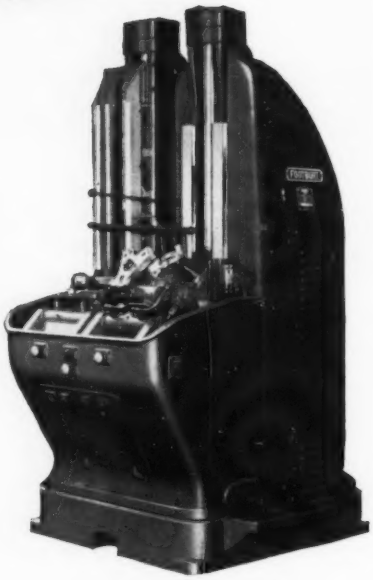
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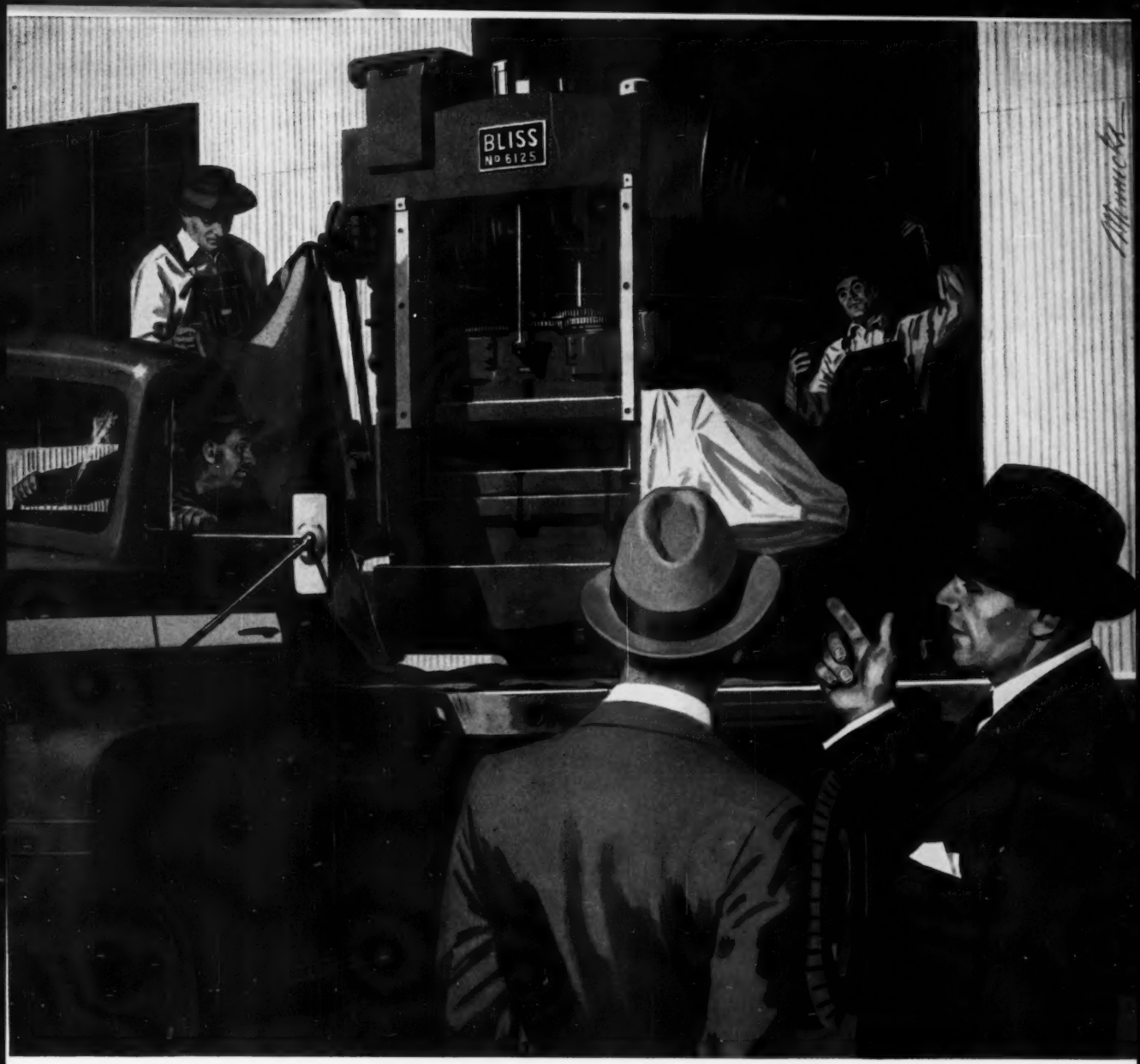
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CIMCOOL PERMITS FASTER SPEEDS and feeds, because of its chemical lubricity. It combines friction reduction and cooling capacity in a degree never before attained by old fashioned lubricants.

CIMCOOL IS CLEANER TO USE because it doesn't soil hands or clothing. It contains no skin irritants. And it's safer because it leaves no slippery film on shoes, floor, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

Watch *your* average go up when you switch to CIMCOOL. We *know* that CIMCOOL will keep you out of a slump every day in your plant. So call your CIMCOOL Distributor today. He'll be glad to give you full information on all the advantages of CIMCOOL concentrate—as well as details on the entire family of CIMCOOL Cutting Fluids. Or contact us direct and we'll have one of our Cincinnati Milling Machine trained machinists call on you—without cost or obligation, of course. Write, wire or phone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

CIMCOOL CUTTING FLUIDS

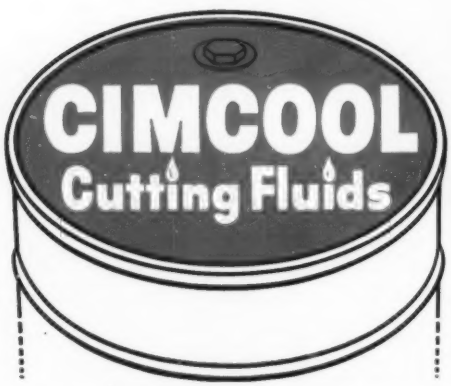
CIMCOOL **S2 Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMPLUS—The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Concentrates (AA, NC, SS)**—For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

Also, CIMCOOL Bactericide and CIMCOOL Machine Cleaner.



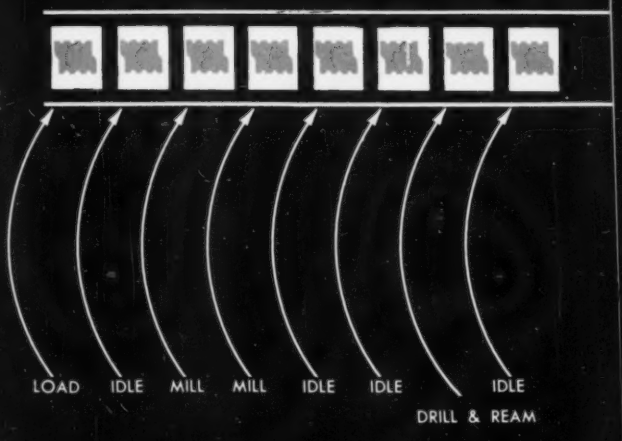
for 100% of all metal cutting jobs. The Answer is Pink!

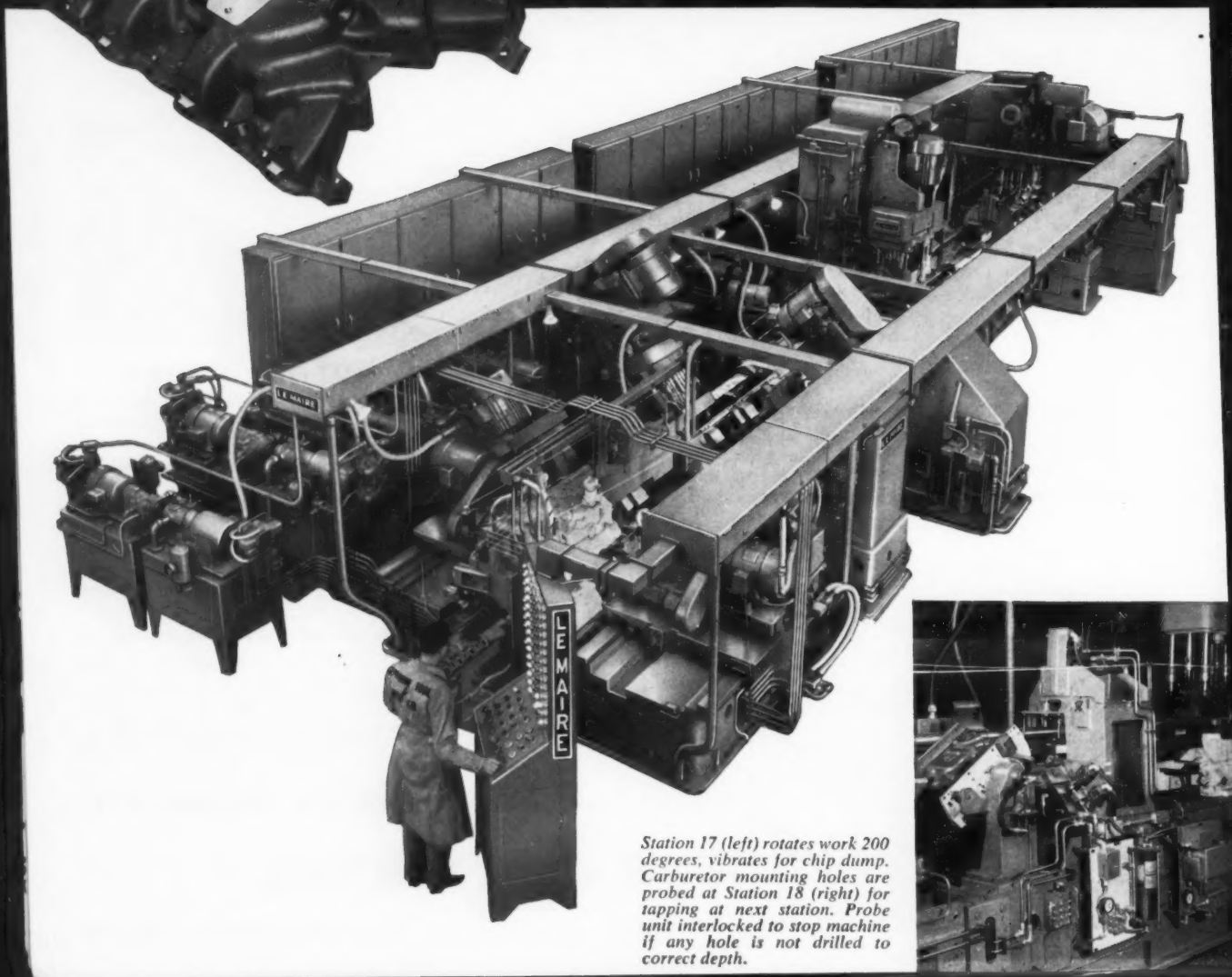
Production-proved products of The Cincinnati Milling Machine Co.

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PRODUCING

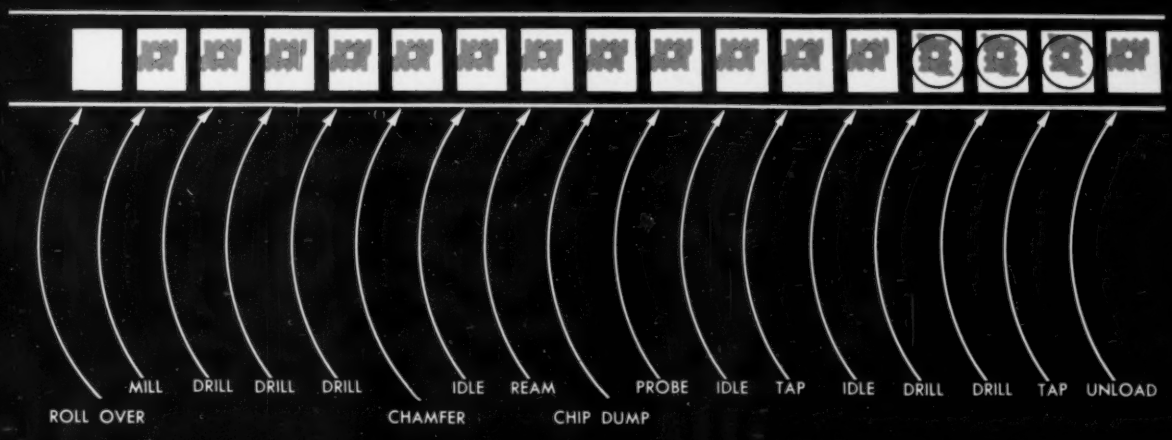






Station 17 (left) rotates work 200 degrees, vibrates for chip dump. Carburetor mounting holes are probed at Station 18 (right) for tapping at next station. Probe unit interlocked to stop machine if any hole is not drilled to correct depth.

with LE MAIRE



Truck Manifolds Completely Machined, Re-positioned 5 Times, in 55 Seconds

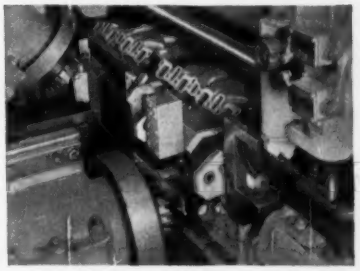
This 25-station LeMaire "Producer" completely machines three different styles of truck engine manifold castings. The machine is built for transfer-through operation and features automatic loading and clamping at each station. The part is re-positioned five times while in process during the 55-second machining cycle, including one 180 degree roll-over, one rotation for vibratory chip removal, indexing for a probing operation, one 90 degree index and re-index.

Features include: Unitized "building block" construction, with provision made for future changes—lighting at every work station—complete electrical interlock and individual selector switches and controls at each work station—"PresTest" lights on main control console—automatic selective lubrication of fixtures and ways—lights indicating "Automatic" or "Manual" control for safety during setups — electrical and hydraulic systems to J.I.C. — 189 hp electrical system—hardened and ground wear surfaces.

Here is another successful *producing* installation, designed, manufactured and tooled by LeMaire. Tell us about *your* next production machining problem.



Manifold mounting holes are drilled and one hole is reamed for precision location in following operations at Station 7.



Locating faces for subsequent operations milled on both sides of work at Station 3. Cutters at Station 4 mill both manifold faces, are retracted by cross slide after stroke to minimize wear.



Inserted blade cutter mills carburetor mounting pad at Station 10.

LE MAIRE MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD
DEARBORN, MICHIGAN

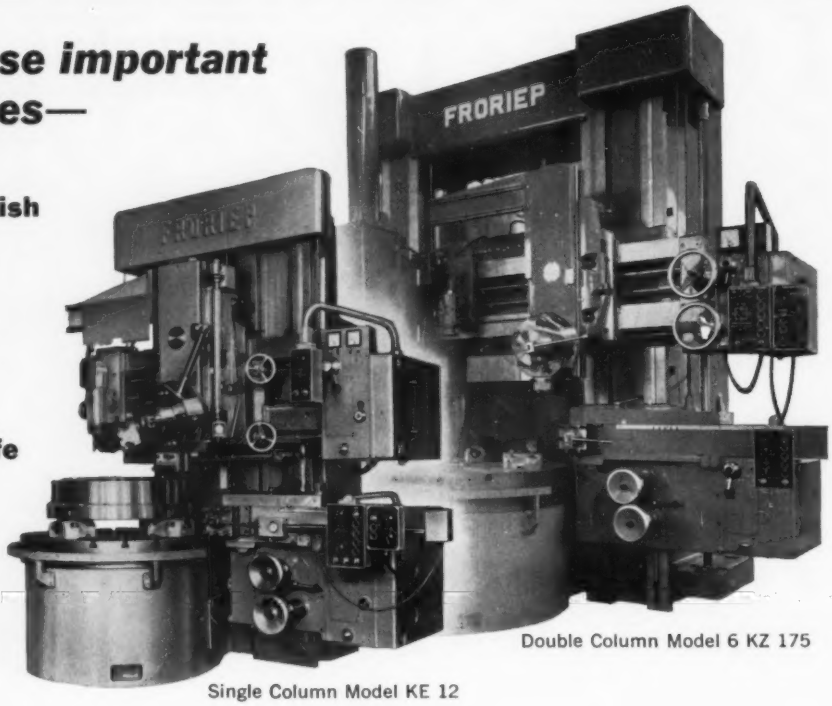
Designers and Builders of
Special High-Production Machines

correct depth.

Constant Cutting Speed on FRORIEP Vertical Boring Mills

Provides these important advantages—

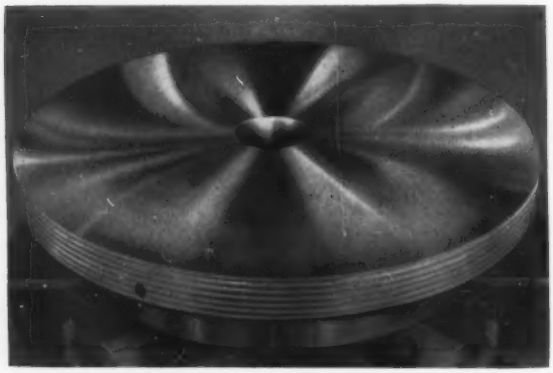
- **Equal surface finish over the entire facing range**
- **Greatly reduced cutting time**
- **Increased tool life**
- **Less down time**



Double Column Model 6 KZ 175

Single Column Model KE 12

Electro-magnetic clutches on a FRORIEP let you maintain constant cutting speed—regardless of decreasing diameter. By a remote electric control you can change quickly to any available speed—without stopping the table. You can adapt table revolutions instantly to the most economical cutting speed for any diameter. If desired, speed can also be set to change automatically, gradually increasing as cutter moves toward the center—and without interrupting the cut.



Uniform surface finish produced by a Froriep

Simple, conveniently placed push buttons and switches control feeds and rapid motion of turret, cross rail and side arm. Cross rail head and side arm operate independently with 12 pre-selected feeds each.

An electric tracer attachment will copy 90° in and 90° out, reproducing almost any shape but undercuts. Automatic tripping devices and combined taper-turning and threading attachment add even more versatility.

Capacities Available Single column models provide a choice of table diameters from 40″ to 63″; double column models from 69″ on up. Special designs also available on request.

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DISCOVERED!

...new way to keep cutting fluids as fresh as a daisy!



SEE NEXT TWO PAGES



DISCOVERED... A NEW WAY TO KEEP COOLANTS FRESH AS A DAISY!

Shop tests show ELCIDE 75 keeps cutting fluids fresh longer than ever before

Now . . . there's a new and better way to control the harmful bacteria that cause oil-water emulsion breakdown, acidic corrosion, and rancid odor. It's Elcide 75 . . . a product directly related to one of the most powerful bacteria killers used in medical science today . . . a material that has proved itself in the exacting field of surgical practice and has now been adapted to solve the problem of bacterial growth in soluble oil emulsions.

A large Midwestern manufacturing plant tested Elcide 75 under actual job conditions.

They found that one ounce of Elcide 75 added to each 4 gallons of oil-water emulsion . . .

extended useful life of the emulsion 5½ times . . .

greatly reduced cutting oil requirements . . .

delayed odor and emulsion break for 22 weeks, while untreated machines had to be dumped at the end of four weeks . . .

proportionately reduced down time for recharging . . .

was safe and nontoxic . . .

eliminated bacterial slime and reduced acidic corrosion . . .

drastically reduced their disposal problems.

WHAT ELCIDE 75 CAN DO FOR YOU

This combination of inhibitors can extend the life of your oil-water emulsions 2 to 4 times, or more, and can dramatically cut your oil-concentrate purchases. At the same time, production will increase because you have less down time for recharging.

ELI LILLY AND COMPANY · AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION
INDIANAPOLIS 6, INDIANA
TELEPHONE: MELROSE 6-2211



This is one of the causes of emulsion trouble. These are *Pseudomonads*, one of the many harmful types of bacteria found in oil-water emulsions. These, and other bacteria, enter emulsions through the air, water, and plant debris. They set the stage for a chain reaction which causes odor, corrosion, and costly emulsion breakdown.

Prior to Elcide 75, no single inhibitor was able to control the full range of bacterial growth. Certain of these bacteria quickly develop resistance to single inhibitors and continue to flourish. Now, Elcide 75 controls a wider range of bacteria because it is an effective combination of bactericidal agents. This has been proved in shop tests.

In certain areas where waste-oil disposal is a problem, the use of Elcide 75 proportionately reduces the size of the problem.

Elcide 75 also contributes to better products and longer machine-tool life. Bacterial contamination causes acidic decomposition of the emulsion and sets up conditions for corrosion. By controlling the bacteria, you eliminate this source of trouble.

Employees like Elcide 75 because, when added to the emulsion, it is completely safe. In another recent test involving over 1000 machines, it was shown that Elcide 75 was safe, nontoxic, and harmless to sensitive skin. It also reduces the chance for bacterial infection caused by contaminated emulsion.

YOU KNOW WHAT YOU GET WHEN YOU BUY ELCIDE 75

With Elcide 75, you know you have the proper amount for effective treatment because you add it to your emulsions right in your plant. The standard recommendation is one ounce of Elcide 75 per 4 gallons of oil-water emulsion.

PROVE IT TO YOURSELF . . . TRY ELCIDE 75 IN YOUR PLANT

The best way to determine the value of Elcide 75 is to try it under your normal plant conditions, using your regular oil-water emulsion. After you've had an opportunity to compare results, we believe you'll agree that Elcide 75 is a valuable discovery that will greatly increase your plant efficiency.

PRODUCT SPECIFICATIONS ELCIDE 75

(Lilly's brand of bactericide for cutting fluids)

Active Ingredients—Thimerosal (Sodium Ethylmercuri Thiosalicylate) and Sodium o-phenylphenate.

Package	Price per Gal.
1-gallon polyethylene . . .	$8.50
5-gallon polyethylene . . .	$8.00
55-gallon stainless steel . . .	$6.50

Terms: 1%, 10th prox.; net, 30th prox. F.O.B. Indianapolis. Transportation paid via carrier of our selection.

For further information or to place your order, phone or write.

ELCIDE 75™

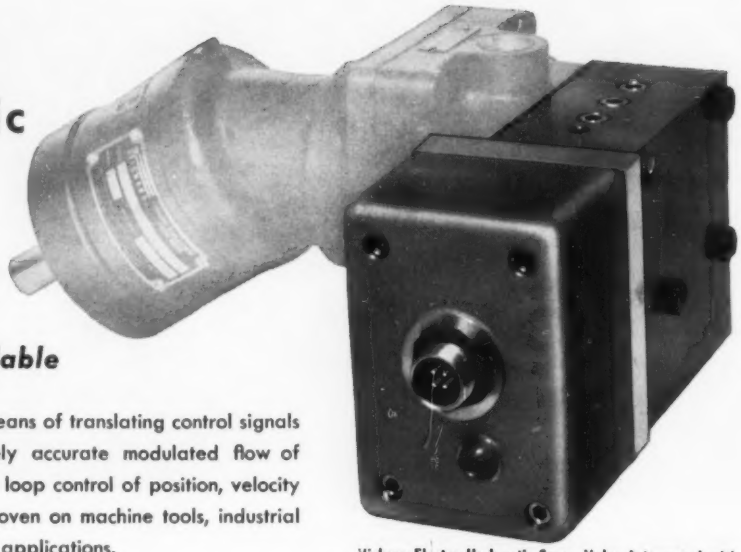
PATENT PENDING

Lilly

New VICKERS® Electro-Hydraulic Servo Valve

has numerous advantages for industrial use:

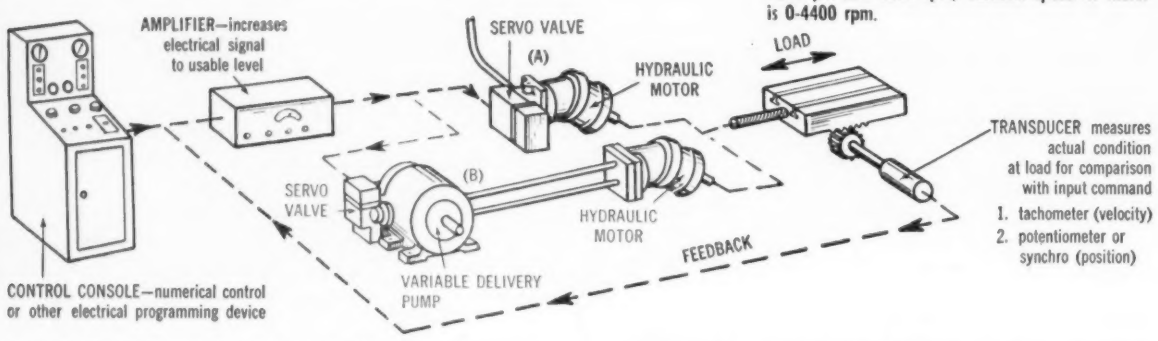
- ***Extremely Accurate***
- ***Simple • Rugged • Dependable***



Vickers Electro-Hydraulic Servo Valve integrated with piston type hydraulic motor provides a minimum amount of oil under compression. Integral cross line relief valves are provided as well as variable cross line orifice for controlling viscous damping. This "package" can provide approximately 20 hp @ 3000 psi and 3600 rpm; variable speed of motor is 0-4400 rpm.

This valve provides a simple, dependable means of translating control signals from electronic programming into extremely accurate modulated flow of hydraulic power for fast and precise closed loop control of position, velocity and acceleration. Performance has been proven on machine tools, industrial processing equipment and ground ordnance applications.

Simplicity and reliability are exceptional . . . only four moving parts are required. Mechanical feedback linkage with unique variable fulcrum provides optimum flexibility for various conditions of flow, response and pressure. For further information, write for Vickers Engineering Bulletin 58-74.

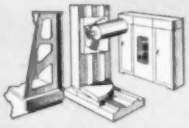


Now the flexibility of electronic control can easily be applied to versatile hydraulic power. Vickers new industrial electro-hydraulic servo valve is used (A) to directly regulate the oil to an actuator (valve motor system). Shown in blue is an alternate application (B) for higher flows when the valve controls a variable volume pump (servo pump system).

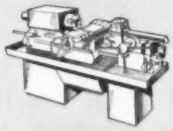
REPRESENTATIVE SERVO VALVE APPLICATIONS



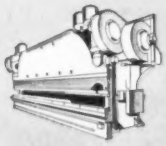
PRESS
Ram velocity controlled accurately during all cycles.



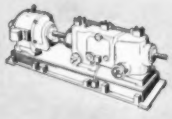
MILLING MACHINE
Precision control of velocity, position and acceleration of slides and tables.



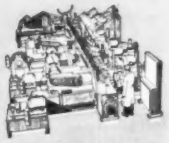
LATHE
Exact feed rate and position control of cutting tool.



PRESS BRAKE
Cylinders synchronized precisely.



VARIABLE SPEED DRIVE
Accurate velocity control of spindle speeds for test stands or machine tools.



PROCESS LINE
Programmed control of Material Handling and machine sequencing.

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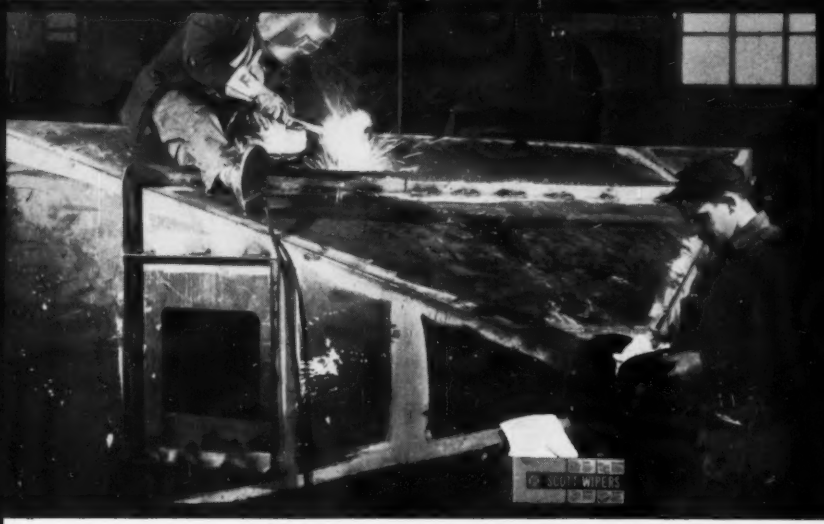
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more data on any products advertised this issue use card, page 193

people buy Scott Wipers for many reasons:



Mr. Swenson reports: "Prat-Daniel uses Scott Wipers for wiping bearings and shafts in the balancing department; for wiping steel plate prior to layout and processing; for wiping up oil and grease; for cleaning welders' face masks, and many other tough jobs."





Prat-Daniel says: "We save 40% annually with Scott Wipers... and eliminated a fire hazard!"

The Prat-Daniel Corporation, South Norwalk, Connecticut, makes fan-stacks, fans, tubular and spiral dust collectors. Mr. Inge Swenson, General Superintendent, tells us: "We used waste before, and employees got the habit of letting oil-soaked heaps of waste accumulate. Now we dispose of Scott Wipers daily." As Mr. Swenson says, much work here is of a dirty, grimy nature, and employees like soft, absorbent Scott Wipers fresh from the box each time for wiping hands and face. Scott Wipers were first tested for 2 months in the bearings department —considered the toughest test—and their success here led to use throughout the plant. Annual savings: 40%.

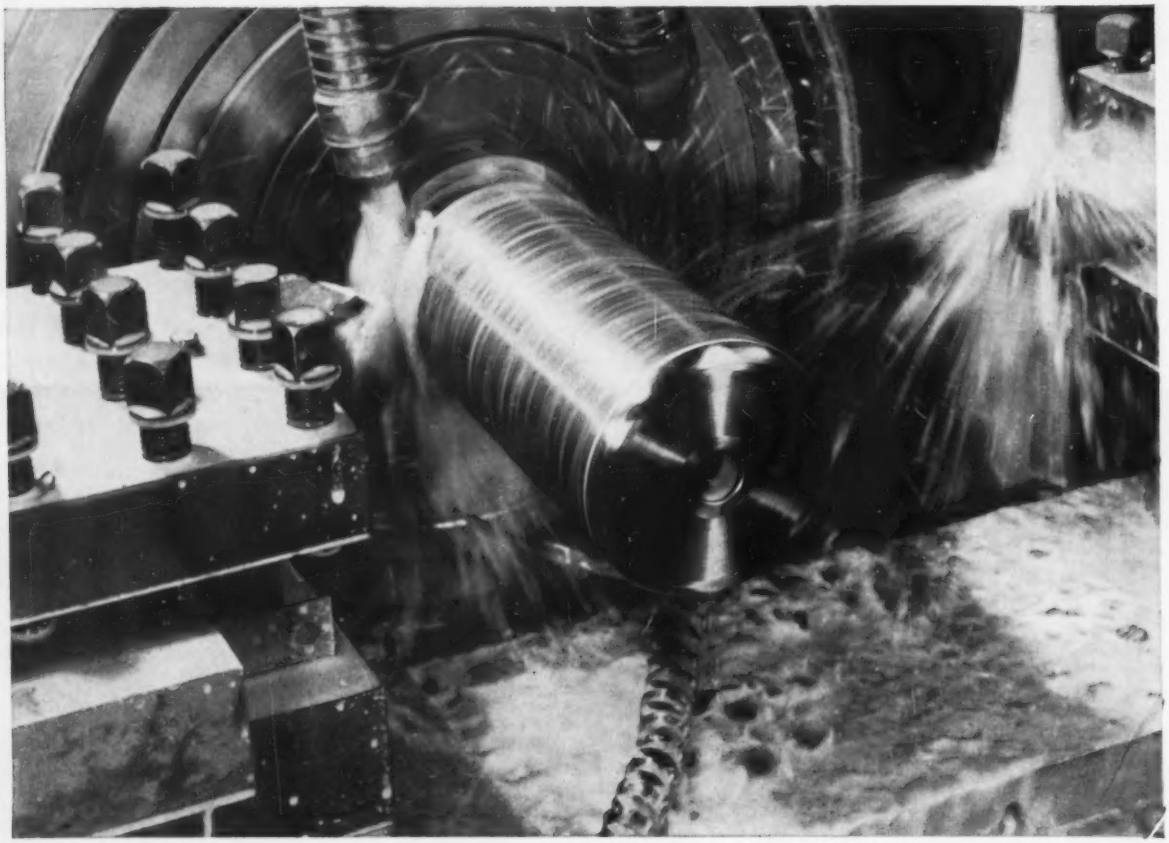




SCOTT PAPER

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Maker of the famous Scott paper products you use in your home.
See "Father Knows Best" on CBS-TV.



How to get more out of your automatic machine tools — — at no extra cost

STOPPING your automatic machine tools for adjustment reduces their efficiency, costs you money every time you do it. But with *uniform* steel machining bars, you cut down these costly interruptions. The greater the uniformity of the steel you machine, the more available you make your machine tools for increased production.

The high quality of Timken® fine alloy steel is uniform from bar to bar, heat to heat, order to order. We make sure of it by taking extra quality control steps. For example, we were first in the steel industry to use a direct-reading spectrometer to insure uniform composition right up to the instant of tapping. It also helps keep grain size uniform.

Your order is handled individually. We target our conditioning procedures to your end use requirements. And we remove any surface defects before rolling to the required bar size.

That's why Timken fine alloy steel bars machine fast, easily and with good surface finish. Scrap loss is reduced. Machine time is saved. The quality of your finished products never varies.

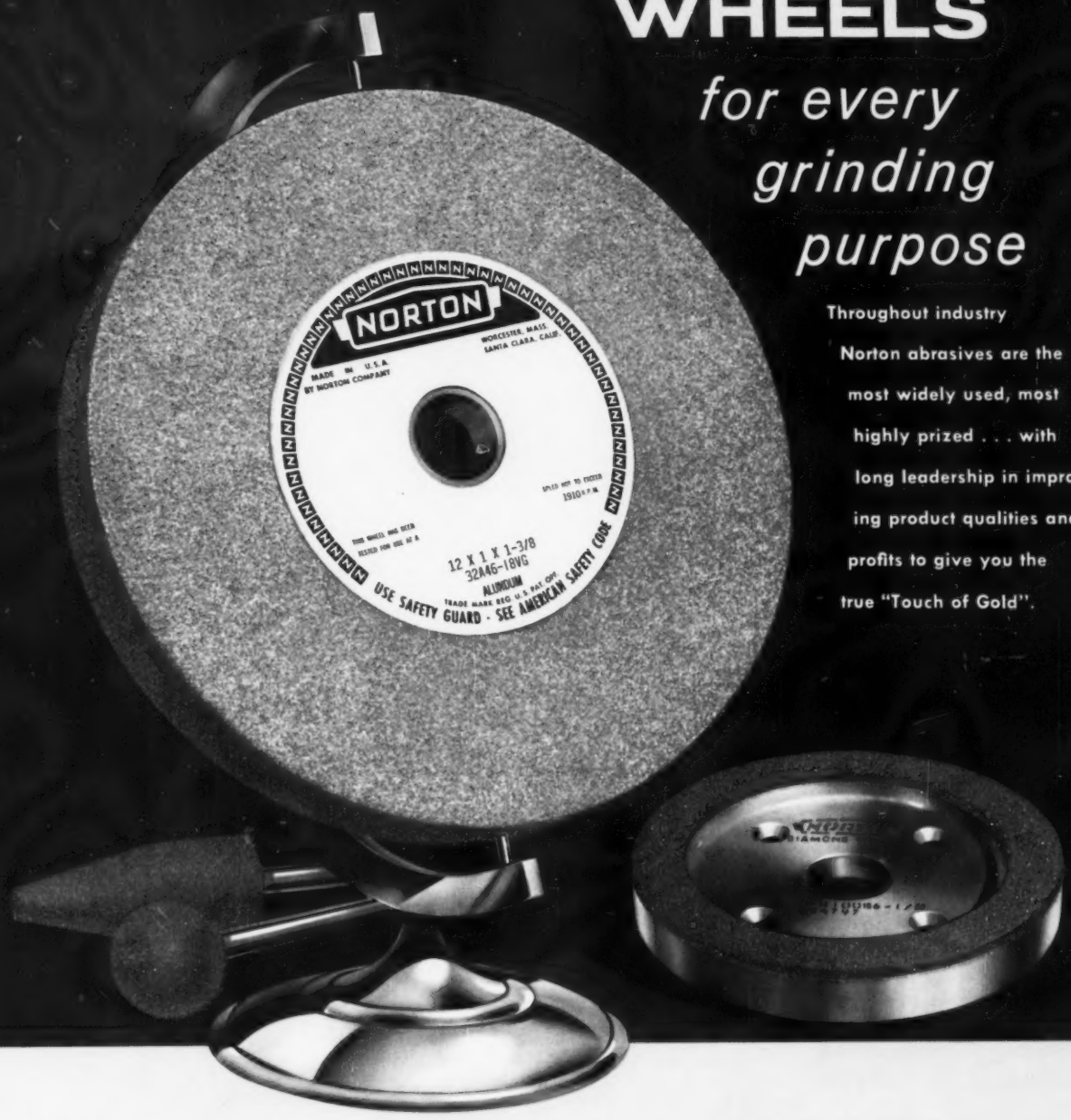
For greater uniformity in the steel you use, let our Technical Staff recommend the correct analysis for your machining bar requirements. You'll save time and money—every time. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

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SELECTION IN ACTION For ordinary grinding jobs the vast amount of Norton know-how literature tells you how to select exactly the right wheels, while the many Norton films show the best grinding methods. But you may have new, unusual problems. Then, your distributor's Norton factory-trained specialist by studying your jobs can help you find the right solutions in quick time. And if necessary, he'll call in your regional Norton Abrasive Engineer for additional technical advice. With experts like these, the grinding wheels you need will be proved in action—on your machines.





DISCOVERING MUCH MORE Norton laboratory researchers, numbering over 180 scientists and technicians, are constantly seeking to find out a great deal more about abrasives and grinding wheels. Their chief interest is in developing new abrasives, new abrasive products and improved grinding techniques. Their many successes in research of this nature have stepped up grinding progress to lower your grinding costs.

THE RIGHT WHEELS ARE RIGHT AT HAND Your Norton distributor is careful to keep his stocks fully adequate to meet all needs of his area. That's true, too, of the stocks in the five big, strategically located Norton branch warehouses — in the Norton California plant — and of the gigantic stocks at Worcester in "Norton City" — the world's largest grinding wheel plant, Headquarters of the "Touch of Gold."



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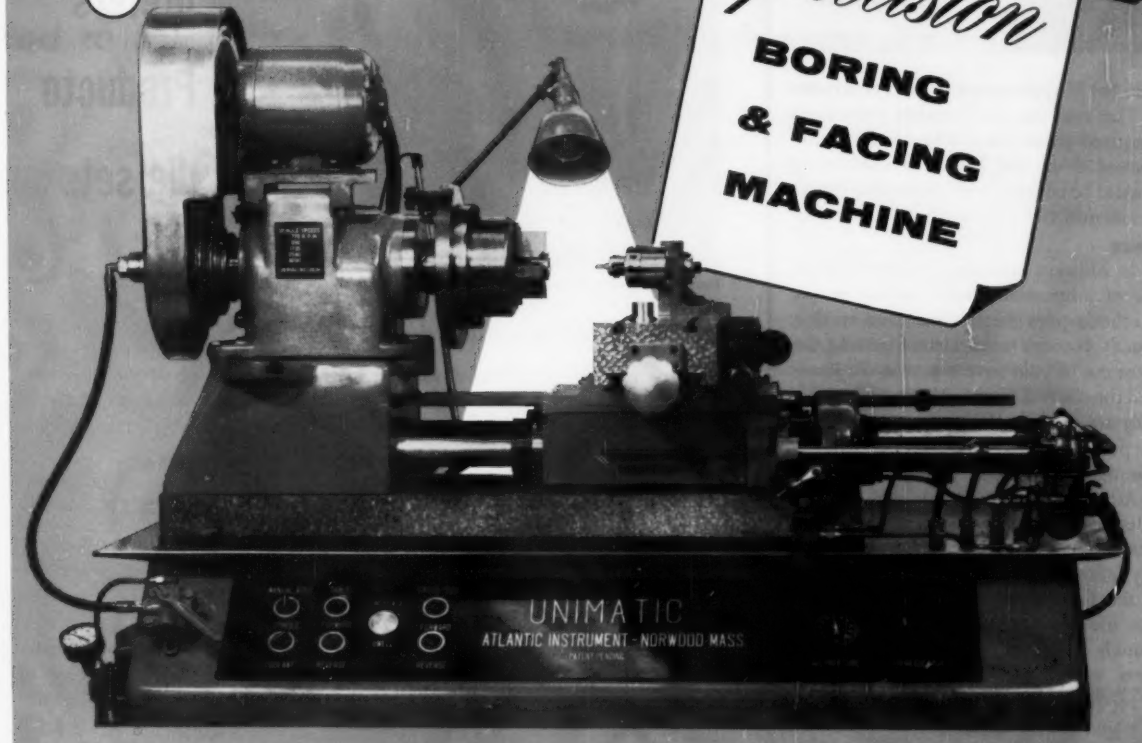
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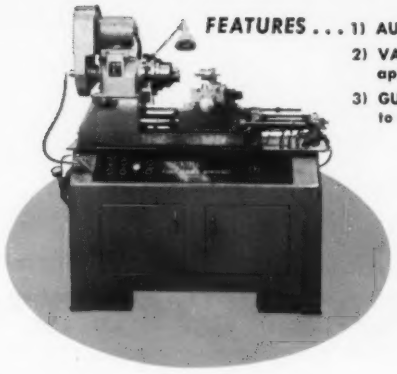
BEHR-MANNING DIVISION
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58

UNIMATIC...

HIGH *precision* **BORING & FACING MACHINE**





FEATURES . . . 1) **AUTOMATIC CYCLING**
2) **VARIABLE FEED** approaches and returns
3) **GUARANTEED** to hold work to .0002"

Designed and built by ATLANTIC INSTRUMENT COMPANY for their own use . . . and now offered as a type and size of machine for which there is a strong demand, especially in the instrument and allied industries, where close tolerances must be held.

The UNIMATIC *comprises an extremely accurate machine element, mounted on a granite base scraped to a tolerance of .00005", with other features (fully explained in our catalog) neutralizing the effects of temperature variations.*

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Talking About Die Sets



with

Phil Marsilius

Executive Vice-President
The Producto Machine Co.

Die Set Maintenance in the Pressroom—The vital die-maintenance procedures required periodically when a die is removed from the press for sharpening should be coupled with systematic die set inspection and maintenance in the pressroom.

In addition to having a planned schedule of lubrication (based on any of the methods previously discussed in this space), you can make sure of getting the most out of your investment in die sets—and the costly dies and presses with which they are used—by following a simple set of procedures for inspecting and maintaining die sets in the pressroom.

Although there are no hard-and-fast rules that can be established for all die sets, the procedure listed below is generally followed at leading stampings plants in the East. These companies point out that die sets used in the cutting of extremely thin material or for very critical parts would naturally require a more stringent inspection than those used for blanking heavy material or for comparatively simple parts.

At one plant, specializing in long runs of close-tolerance parts for the electronics industry, the procedure followed is:

1. No inspection of the die set during production run unless, of course, there is overheating, pick-up on the guide pins or other obvious difficulties.

2. When the die is taken off the press for sharpening or maintenance, the die set is visually inspected for pick-up or score marks on either the guide pins or bushings. Pins and bushings are carefully cleaned to remove excess lubricant.

3. After approximately 1,500,000 strokes, the set is thoroughly checked for wear on both the pins and bushings. On the average, up to .0003″ wear on pins and bushings is allowed before replacement with new components is scheduled. In addition, the die set is placed on a surface plate and an indicator is placed over one end of the set. An attempt is then made to rock or twist the set by hand to establish how much the die set can be deflected. On a 10″ set, a maximum of .005″, but usually less, total deflection is allowed.

Because the die set plays such an important part in prolonging the accuracy and lifetime of a die, it pays to take the little extra time required to do justice to die set maintenance in the pressroom.

4. During regular or periodic regrinds, the die set is not checked for bent or distorted punch and die holders unless the die has been damaged or there is reason to believe the set may have warped.

During the overall period, if the pins and bushings are replaced, the punch and die holders themselves are checked for warpage or distortion. If necessary, these components are reground prior to assembling the new pins and bushings.



Four-stage blanking and shaving die, Lenkeit Machine & Tool Co., Inc.

Why the pressroom foreman prefers Producto die sets

They keep his downtime down

Keeping production *up* and downtime *down* is the main job of the pressroom foreman. He knows Producto die sets can help him do this job successfully because they maintain accuracy for long runs. All catalog steel sets are annealed to prevent distortion.

He is aware that Producto can provide him with any type of die set he needs—whether for standard or special presses—in a wide range of sizes and thicknesses, with or without clamping flanges.

The pressroom foreman knows that Producto guide pins are mirror-finished to eliminate scoring, and that Producto die sets are available with a variety of lubrication devices to keep them "running cool".

He knows, too, that he is not restricted to the use of predetermined press stroke or shut height because Producto offers an unlimited choice of pin and bushing lengths. Moreover, he can get the bolster he needs to protect his die at the same time he gets his die set. Both die set and bolster can be ordered in steel or cast semi-steel depending on strength requirements.

The pressroom foreman realizes that Producto Qwik-Fit Die Sets make "take-apart-and-put-together" easy during die maintenance. He also knows that Qwik-Fit removable pins and clamp-type bronze bushings are available when the application calls for them.

He can *produce more* with Producto die sets. So can you.

A WEALTH OF DIE SET KNOWLEDGE is packed into Producto's Catalog No. 11 and regular issues of *Die Set Digest*. Write today for these free aids.

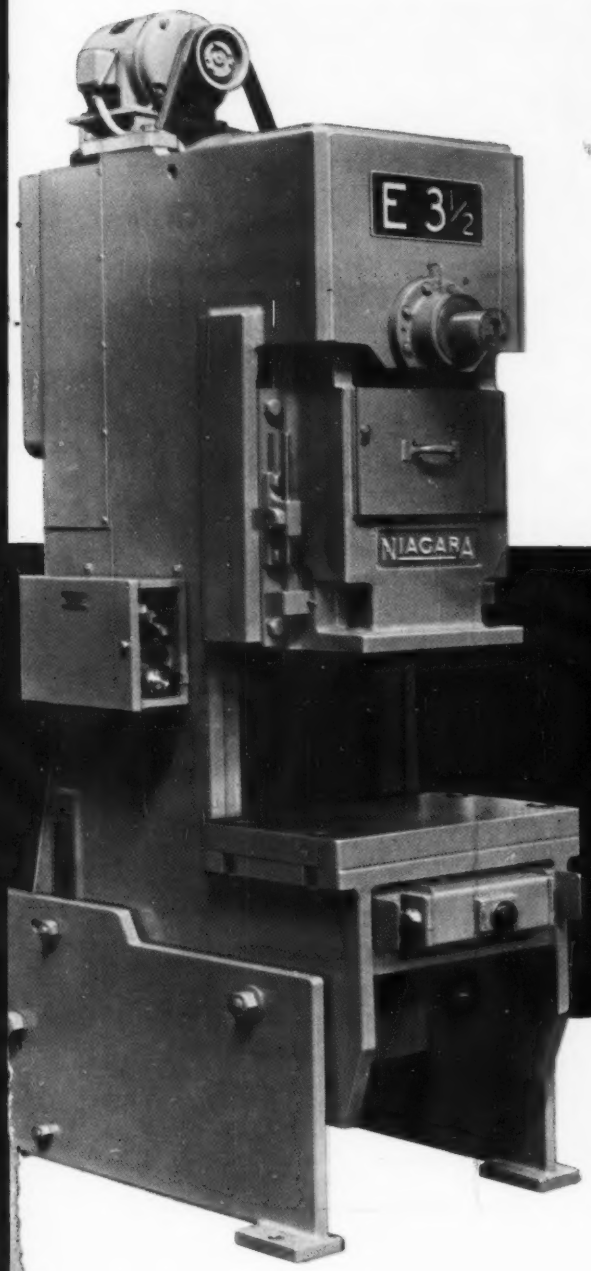


THE PRODUCTO MACHINE COMPANY
985 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used
PRODUCTO
PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

NEW! ULTRA-MODERN 45-TON OBI

added to Niagara's exclusive front-to-back crankshaft series



READY FOR YOU

. . . a brand new addition to industry's most advanced line of OBI's! Years ahead of any press within its range, this 45-ton newcomer is available plain or geared. The front-to-back arrangement of its 3½" crankshaft is, of course, a distinguishing mark of Niagara's famous Series E.

No other OBI press design has been so widely acclaimed. And no wonder . . . for no other OBI boasts so many unique advantages:

Full support to wide dies. Greater resistance to off-center loading. Accurate alignment of slide with minimized tendency to cock. Crankshaft deflection minimized. Substantially increased die life. Smoother, safer performance. Exposed overhanging gears, flywheel and other mechanisms eliminated. Less floor space.



GET THE FULL STORY on this new 45-ton wonder-worker as well as the 4 other sizes in the Series E family (up thru 200-ton capacities, and 7½" shaft diameters, standard and automated models). Write for illustrated Bulletin 56.

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.

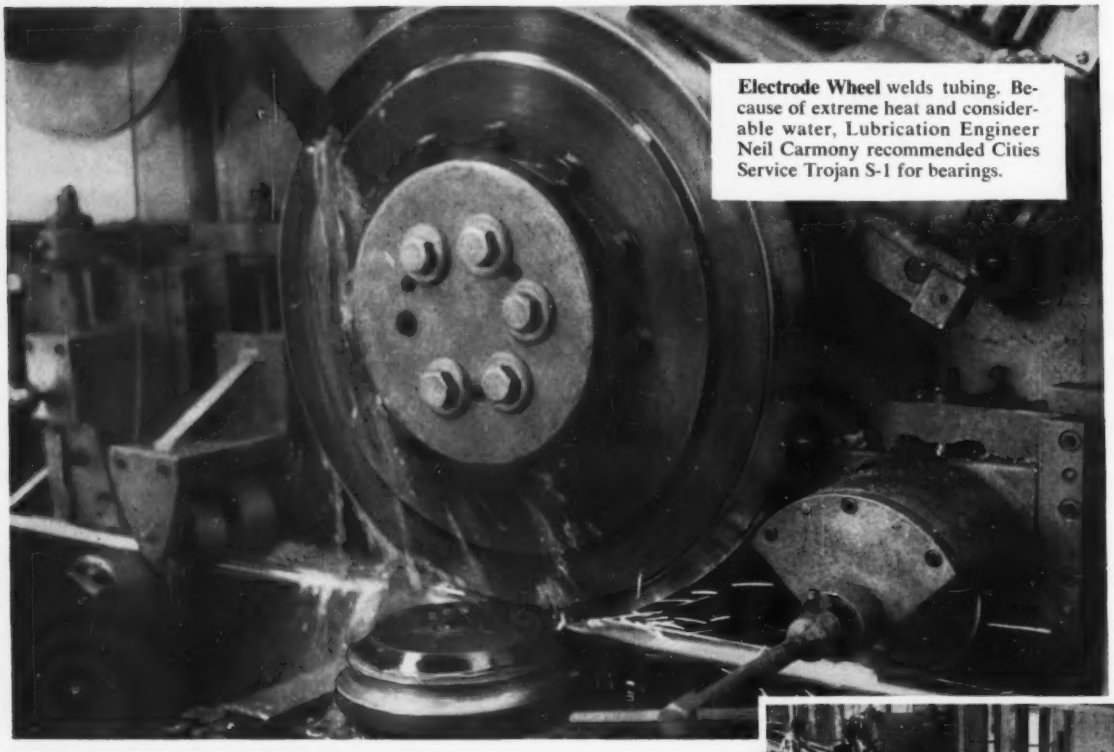
- Rigid crankshaft with close coupled main bearings each side of crank pin.
- Widest spaced OBI gibbing (L to R) in the industry permits wider box section slide to rigidly support a greater slide face area of full JIC dimensions. Guiding of slide is closer to point of die operation because there is no flange interference with gibbing.
- Longest gibbing in the industry, exclusive multiple "V" type, provides the most efficient guiding and accurate alignment of slide for greatest die life.
- Fully concealed, yet readily accessible, driving mechanism.
- Enclosed, rigidly supported gearing operates in sealed oil bath.
- Low inertia, pneumatic friction clutch and brake operate directly on crankshaft — the slowest rotating shaft.
- Precision, hardened, longer-wearing steel gears.
- Rigid, compact all-steel, box type frame.
- Power slide adjustment and power inclining device operate with new, unequaled speed.

NIAGARA

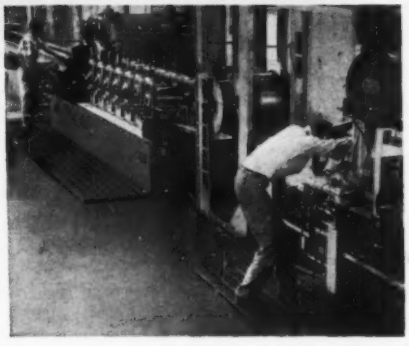
OBI PRESSES SERIES E

DISTRICT OFFICES: Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia / Distributors in principal U.S. cities and major foreign countries.

New Tubing Mill Produces at Speed of 350 Feet Per Minute!



Electrode Wheel welds tubing. Because of extreme heat and considerable water, Lubrication Engineer Neil Carmony recommended Cities Service Trojan S-1 for bearings.



It's Cities Service for Hydraulic System and all lubrication

On January 1, 1957, P&H Tube Corporation put a new mill in production at Bossier City, Louisiana—the only one of its kind in the United States.

Equipped with special drives and worm gears, this unique mill actually produces at the rate of 350 feet per minute—twice the speed of conventional tubing mills!

With speeds like this, you might expect lubrication troubles . . . but P&H Tube Corporation has none. One big reason is the careful study of each machine made by Cities Service Lubrication Engineer Neil Carmony—and the lubrication recommendations he made.

In hydraulic units, for example, Carmony recommended Pacemaker 200-T Hydraulic Oil . . . for he knew its ability to withstand the severest operating temperatures and speeds. He knew that due to its exceptionally high viscosity index and superior compounding, Pacemaker 200-T would give maximum resistance to thinning, oxidation, rust and corrosion.

The wisdom of this decision, as well as the choice of other lubricants shown in the chart at right, was demonstrated recently when P&H Tube Corporation ran off 125,000 feet of tubing in an ordinary eight hour shift—with normal time-out for change-overs!

That's production with a capital P! And if you'd like to improve your production picture, a Cities Service Lubrication Engineer can help you, too. Call the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

What the Cities Service Lubrication Engineer Recommended

Hydraulic units	Pacemaker 200-T
Bearings	Trojan H-2 Grease
Drive units	Pacemaker Oils
Bearings by the mill's electrodes	Trojan S-1

CITIES SERVICE

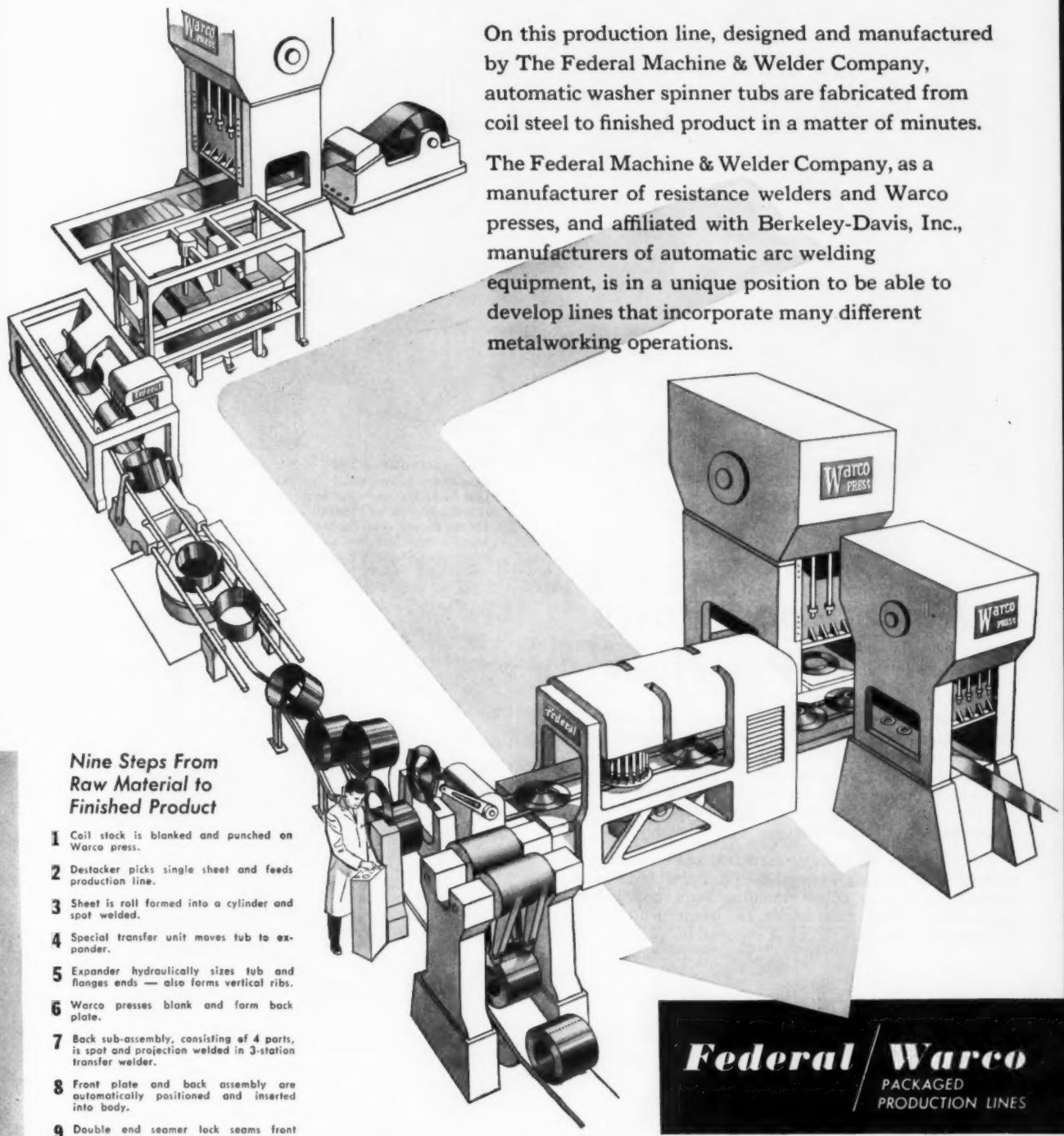
QUALITY PETROLEUM PRODUCTS

THE ACCENT IS ON PRODUCTION

in a production line by FEDERAL

On this production line, designed and manufactured by The Federal Machine & Welder Company, automatic washer spinner tubs are fabricated from coil steel to finished product in a matter of minutes.

The Federal Machine & Welder Company, as a manufacturer of resistance welders and Warco presses, and affiliated with Berkeley-Davis, Inc., manufacturers of automatic arc welding equipment, is in a unique position to be able to develop lines that incorporate many different metalworking operations.



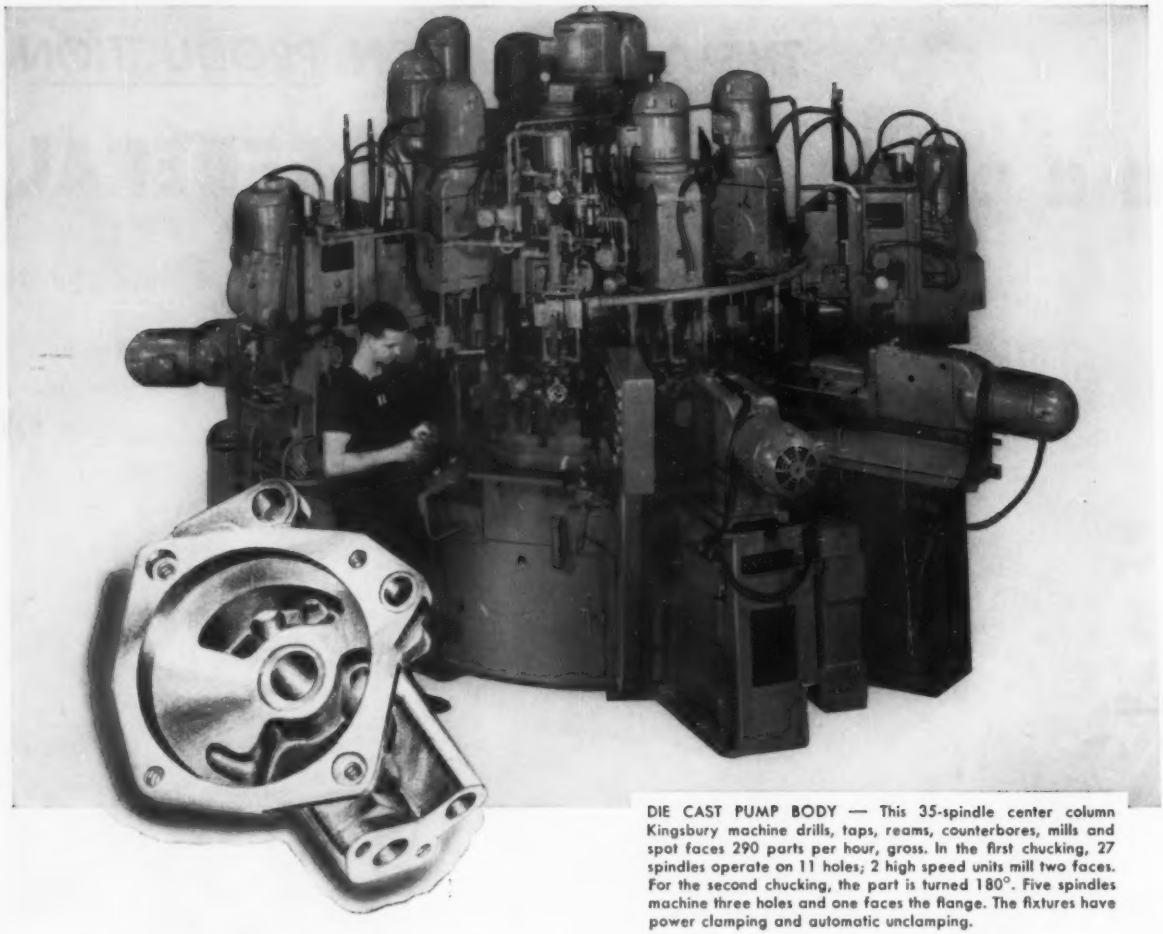
Nine Steps From Raw Material to Finished Product

1. Coil stock is blanked and punched on Warco press.
2. Destacker picks single sheet and feeds production line.
3. Sheet is roll formed into a cylinder and spot welded.
4. Special transfer unit moves tub to expander.
5. Expander hydraulically sizes tub and flanges ends — also forms vertical ribs.
6. Warco presses blank and form back plate.
7. Back sub-assembly, consisting of 4 parts, is spot and projection welded in 3-station transfer welder.
8. Front plate and back assembly are automatically positioned and inserted into body.
9. Double end seamer lock seams front plate and back assembly to body and ejects finished tub.

* Sequence of operations controlled by static relay system designed and built by Federal.

Federal / Warco
PACKAGED PRODUCTION LINES

THE FEDERAL MACHINE AND WELDER COMPANY, WARREN, OHIO
Affiliated with Berkeley-Davis, Inc., Danville, Illinois



DIE CAST PUMP BODY — This 35-spindle center column Kingsbury machine drills, taps, reams, counterbores, mills and spot faces 290 parts per hour, gross. In the first chucking, 27 spindles operate on 11 holes; 2 high speed units mill two faces. For the second chucking, the part is turned 180°. Five spindles machine three holes and one faces the flange. The fixtures have power clamping and automatic unclamping.

More Good Parts Per Hour

One indexing automatic is complex, the other fairly simple. Both produce good parts month after month at high production rates. The reasons are good basic design, rugged and accurate construction. This is true of every Kingsbury machine. To be sure the parts will meet your specifications, we run test samples for your approval before we ship the machine.

For 38 years, Kingsbury machines have been used for drilling and tapping operations on parts for the automotive, appliance, office machine, farm and industrial equipment and other industries. Let us quote on your jobs. Kingsbury Machine Tool Corporation, Keene, N.H.



RADIO PART — This Kingsbury performs nine operations on 560 parts per hour, gross. Three horizontal units with two-spindle auxiliary heads drill, countersink and tap two holes; three vertical units countersink, ream and burnish the axial hole.

KINGSBURY

INDEXING AUTOMATICS for high production drilling and tapping

Acme-Fette rolls threads to tight "specs"



...WITHOUT MAJOR INVESTMENT

The tool engineers of Air-Hydraulic, Inc. were faced with rigid specifications and the necessity of an extremely fine fit and finish for this high temperature hydraulic actuator for aircraft use. Conventional thread cutting methods would have been costly.

After careful study they found that Acme-Fette thread rolling heads would meet all requirements when applied to their *existing turning equipment.* Major machine investment was eliminated and a low rejection rate meant additional economies because threading was the last of a number of costly operations.

The Results

- 1″-20, ¾″-16, and 5/16″-24 threads were rolled 5 times faster than possible with conventional thread cutting dies —thread rolling speeds are equal to turning speeds with high speed tool steels.
- Cold-forming action of the Acme-Fette produced a tougher thread and one 60% smoother than grinding or chasing (a 5 micro-inch finish).
- Rejection rate: less than ½ of 1%.

For cost-reducing ideas showing how you can put Acme-Fette self-opening thread rolling heads to work on your present equipment, send for Bulletin NAF-57A.

The Material

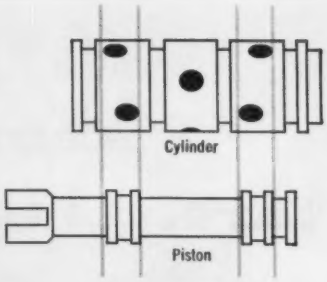
- Steel: 4340—upset forging
- Tensile strength: over 160,000 p.s.i.
- Hardness: 36-40 on Rockwell C scale

National Acme

THE NATIONAL ACME COMPANY
179 East 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

MATCH PISTON LANDS TO CYLINDER PORTS PRECISELY WITH SHEFFIELD'S MICRO-FORM GRINDER



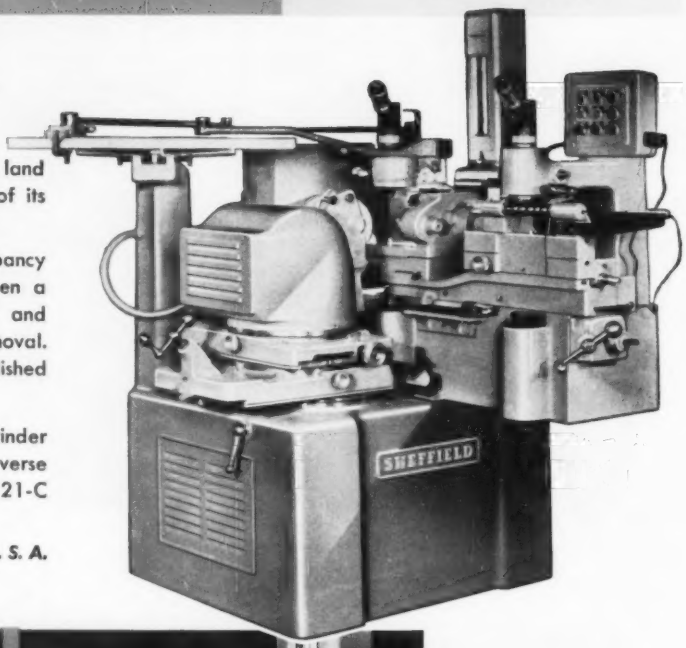
This servo cylinder and piston are typical of the very precisely machined hydraulic components in aircraft propeller and flight control systems.

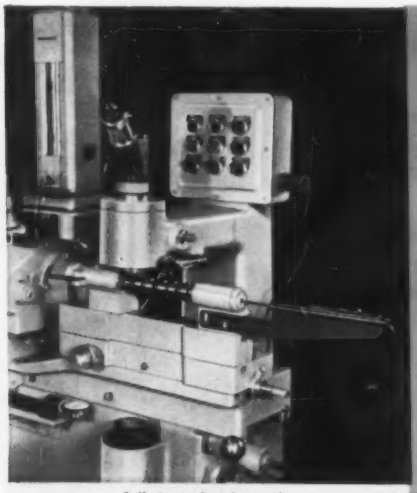
With the actual cylinder as a reference, each piston land is individually ground to match the inside edge of its respective cylinder port.

If a flow test then reveals the slightest discrepancy between land and port edge, the piston is given a finishing touch, using a Sheffield Precisionaire and Airetest Indicator to show progress in stock removal. Thus, the correction of the land face can be accomplished to within ± .000010".

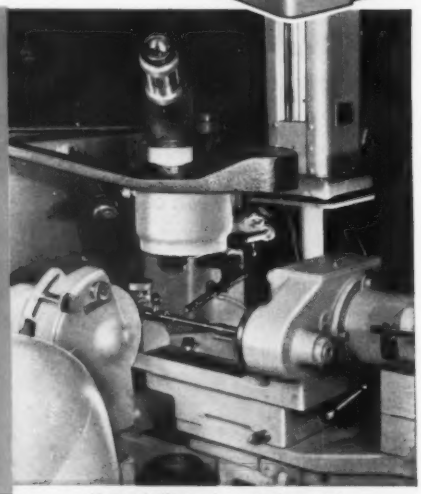
This is typical of the wide range of Micro-Form Grinder applications in duplicating precision profiles or reverse profiles from a master. Write for Bulletin MFG-121-C to Dept. 9.

THE SHEFFIELD CORPORATION, DAYTON 1, OHIO, U. S. A.





Cylinder under observation on auxiliary table.

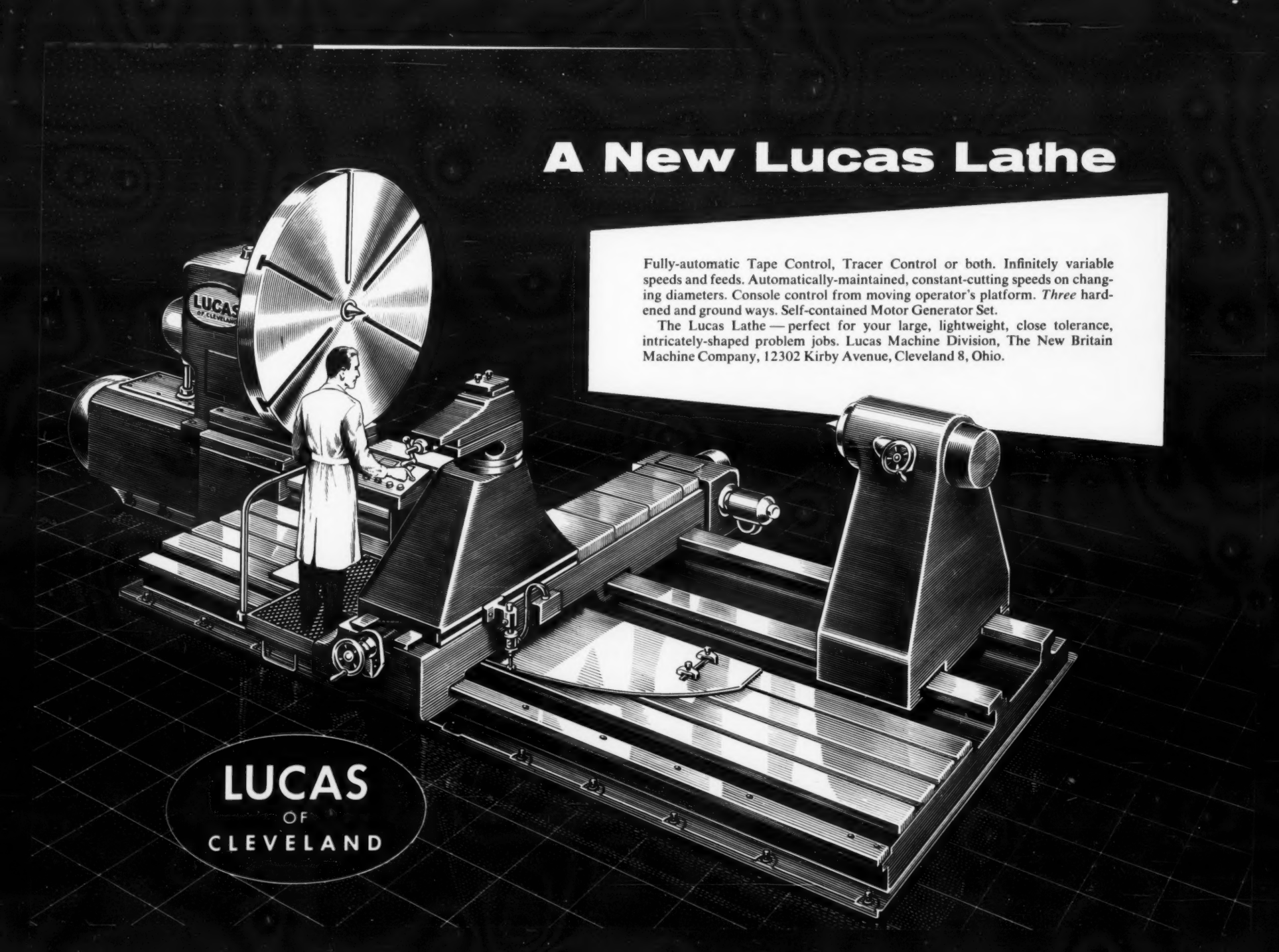


Airetest Indicator shows stock removal in final correction.

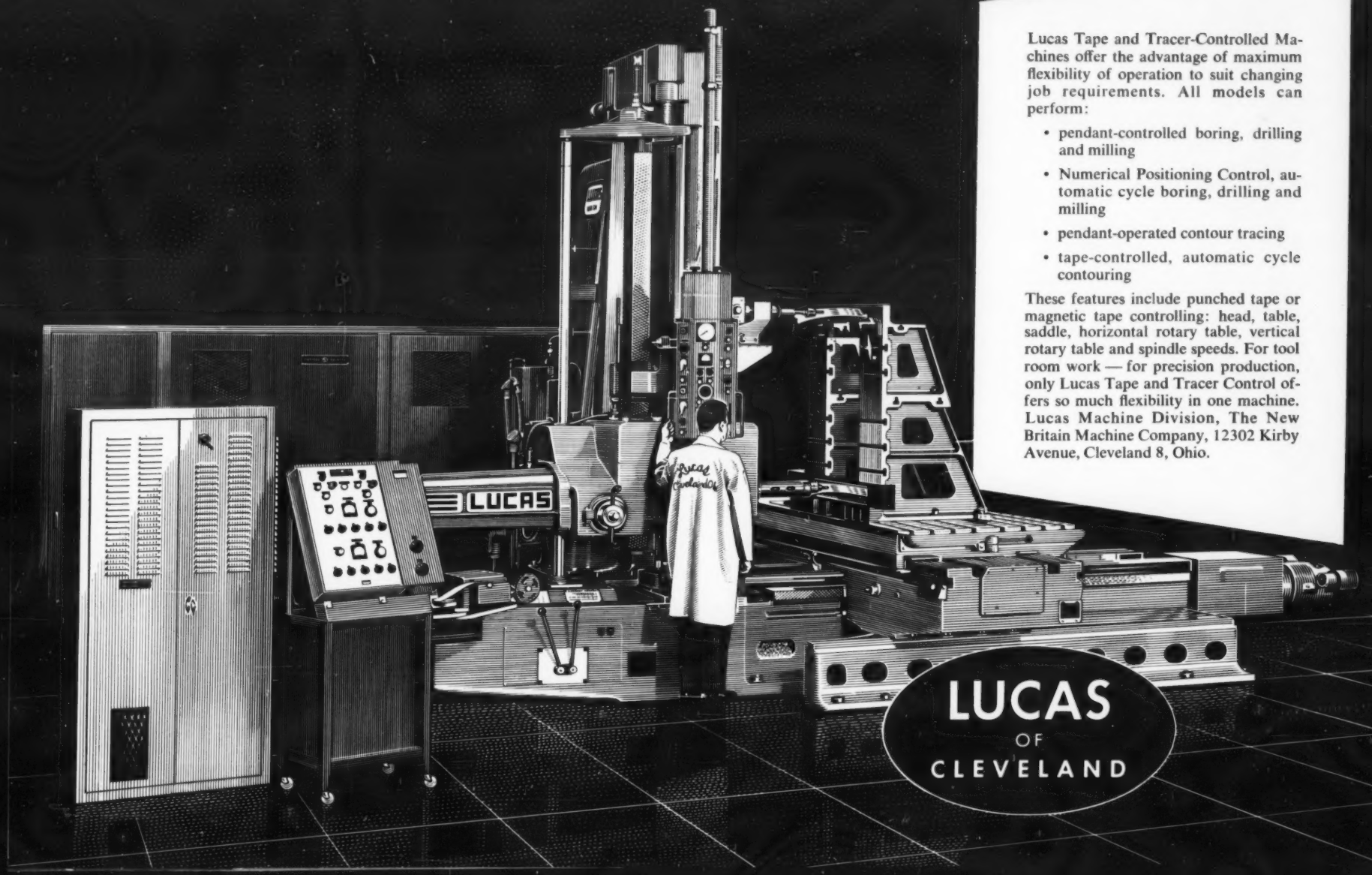
the **SHEFFIELD** *corporation*
of Bendix Aviation

manufacture and measurement for mankind

7560


A New Lucas Lathe
Fully-automatic Tape Control, Tracer Control or both. Infinitely variable speeds and feeds. Automatically-maintained, constant-cutting speeds on changing diameters. Console control from moving operator's platform. *Three* hardened and ground ways. Self-contained Motor Generator Set.
The Lucas Lathe — perfect for your large, lightweight, close tolerance, intricately-shaped problem jobs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.
LUCAS
OF
CLEVELAND

Lucas Tape and Tracer Control



Lucas Tape and Tracer-Controlled Machines offer the advantage of maximum flexibility of operation to suit changing job requirements. All models can perform:

- pendant-controlled boring, drilling and milling
- Numerical Positioning Control, automatic cycle boring, drilling and milling
- pendant-operated contour tracing
- tape-controlled, automatic cycle contouring

These features include punched tape or magnetic tape controlling: head, table, saddle, horizontal rotary table, vertical rotary table and spindle speeds. For tool room work — for precision production, only Lucas Tape and Tracer Control offers so much flexibility in one machine. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

LUCAS
OF
CLEVELAND



Catalog 806 describes the complete quality line of Airco cylinder, manifold, and pipeline **Gas Regulators.** For a copy, send coupon below.



Catalog 818 describes Airco **Hand Torches** for cutting, welding, brazing, flame hardening, descaling. Outfits, tips, accessories. Copy on request.



Airco **Manifolds** for oxygen, acetylene, hydrogen, nitrogen, helium, argon. Simplex or Duplex, stationary or portable systems. Request Catalog 829.



Airco No. 2 portable **Pipe Cutting and Beveling Machine** cuts with speed and accuracy up to 30" diameter. Easy to set up. Send for Catalog 804K.



Airco Portable **No. 10 Radiagraph** accurately cuts straight lines, arcs, circles 3" to 85". Motor driven. Accessories. Catalog 804H.



Airco **No. 20 Radiagraph** and attachments. Makes straight, circular or irregular cuts. Can be carried by one man. Ask for Catalog 804G.

Here's complete information on Airco Gas Cutting and Welding Apparatus—designed to trim your costs—increase your production

Select from these informative Airco Catalogs

In these catalogs, you'll find descriptions and photos of Airco gas regulators, manifolds, hand torches, outfits, tips and accessories to meet practically any need. You'll see how each Airco gas cutting and welding machine operates and what it can do. Many plus features are pointed up. Specs are included.

The speed, variety and accuracy of cutting and welding with Airco quality equipment add up to . . . more production . . . lower costs.

For the catalogs you want, write today . . . or use the coupon.



Airco **No. 41 Radiagraph** for flame hardening, automatic welding. Torch Arm and Holder Assemblies for extra heavy cutting. Catalog 804F. Mail coupon.



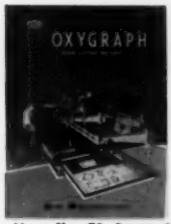
Airco **No. 42 Camograph** flame cutting machine for low cost repetitive production. Set up anywhere in minutes. Ask for Catalog 804D.



Airco **No. 4 Monograph,** single torch, cuts any shape to 56" x 32" x 6". Portable, accurate, low cost. Check Catalog 804E on coupon below.



Airco **No. 48 Duograph,** a multiple torch, medium area, moderate cost machine. Cuts all shapes electronically, magnetically, or manually. Send for Catalog 804C.



Airco **No. 56 Oxygraph** cuts shapes from plates, slabs, billets, forgings. Up to 8 pieces in one pass. Check coupon for Catalog 804B.



Airco **No. 50 Travograph** can cut pieces of any length. Up to 8 torches. Travels on rails. Check Catalog 804A on coupon below.

Air Reduction Sales Co.
150 E. 42 St., New York 17, N. Y.

Please send me the literature checked—

- ☐ Gas Regulators — Catalog 806
- ☐ Hand Torches — Catalog 818
- ☐ Manifolds for gases — Catalog 829
- ☐ No. 2 portable Pipe Cutting Machine — Catalog 804K
- ☐ No. 10 Radiagraph — Catalog 804H
- ☐ No. 20 Radiaeraph — Catalog 804G
- ☐ No. 41 Radiagraph — Catalog 804F
- ☐ No. 42 Camograph — Catalog 804D
- ☐ No. 4 Monograph — Catalog 804E
- ☐ No. 48 Duograph — Catalog 804C
- ☐ No. 56 Oxygraph — Catalog 804B
- ☐ No. 50 Travograph — Catalog 804A
- ☐ Other _____

Name _____

Title or Position _____

Company _____

Street _____ City _____

Zone _____ State _____

AIRCO®

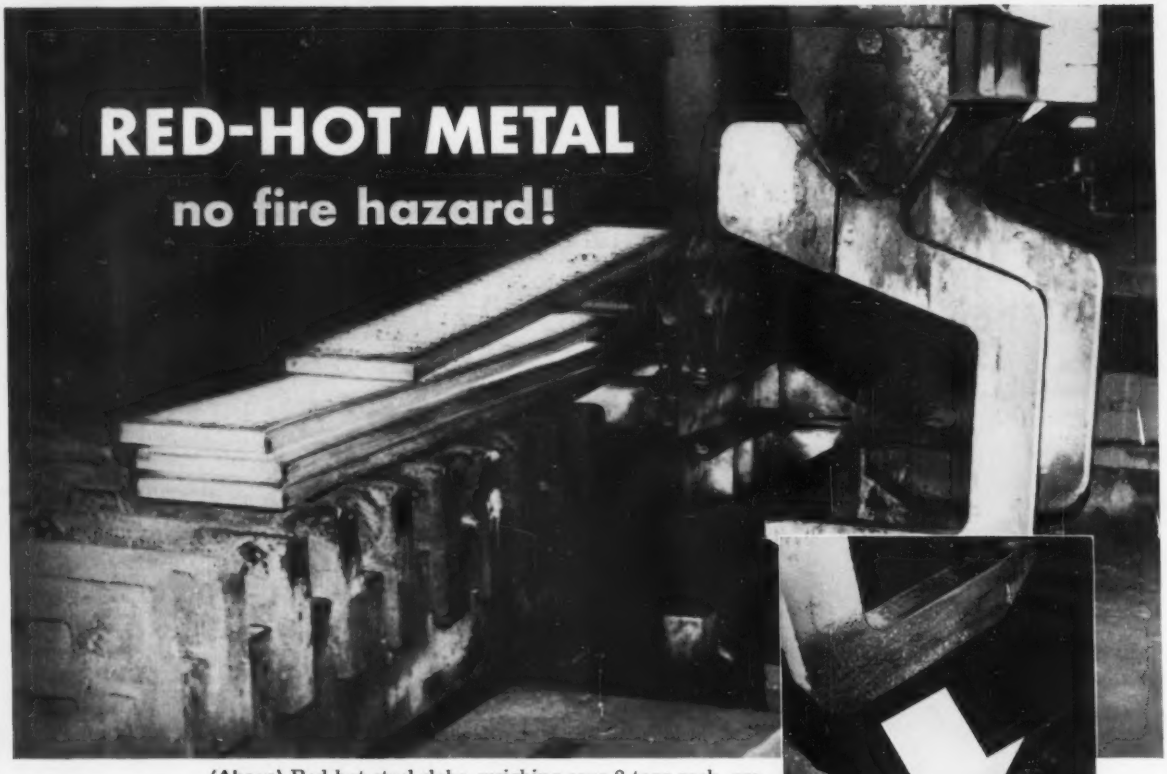
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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** – Industrial gases, welding and cutting equipment • **AIRCO CHEMICAL** – vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • **PURECO**–carbon dioxide–gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • **OHIO**–medical gases and hospital equipment • **NATIONAL CARBIDE**–pipeline acetylene and calcium carbide • **COLTON**–polyvinyl acetate, alcohols, and other synthetic resins.



(Above) Red-hot steel slabs, weighing over 2 tons each, are at arm's length from hydraulic lines filled with Irus Fluid 902—YET NO FIRE HAZARD.

(Right) The distinctive yellow color of Irus Fluid makes it easy to spot and trace hydraulic line leaks.

"After numerous tests, we selected Shell Irus Fluid 902 because of its excellent fire resistance and low cost,"

says Norman Bracht, Lubrication Engineer, Alan Wood Steel Company, Conshohocken, Pa.

A fire in the strip mill, causing serious equipment damage and plant down time, convinced the Alan Wood Steel Company that a switchover to a fire-resistant hydraulic fluid was imperative. After extensive testing with various commercial types, Shell Irus Fluid 902 was selected. Now . . . twelve months later . . . Alan Wood is convinced that serious hydraulic fires in strip mill tilt table are a thing of the past.

Irus* Fluid 902 is a specially compounded water-in-oil emulsion which has exceptional fire resistance. Plant tests show, time after time, that Irus Fluid 902 *actually snuffs out fire!*

Many plant operators, like Alan Wood Steel, have discovered that Irus Fluid is economical . . . costing up to one-third less than other fire-resistant fluids, yet its performance is comparable in every practical respect.

If your present hydraulic equipment is vulnerable to accidental fire hazard, we suggest that you obtain complete technical information on Shell Irus Fluid 902. Write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y. or 100 Bush Street, San Francisco 6, California.

*Registered Trademark

SHELL IRUS FLUID 902

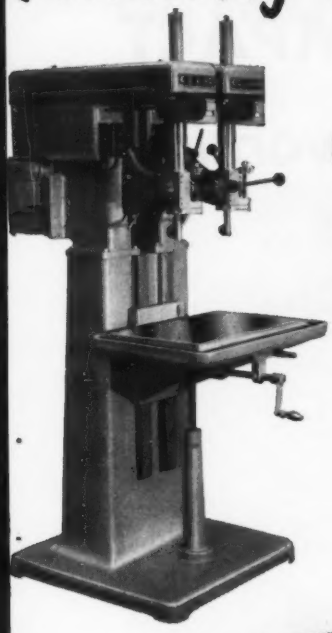
a low-cost, fire-resistant hydraulic fluid

SHELL

EDLUND

"F" SERIES

Infinitely Variable Speeds



Edlund Model 1F

Sensitive machine for small parts and components.

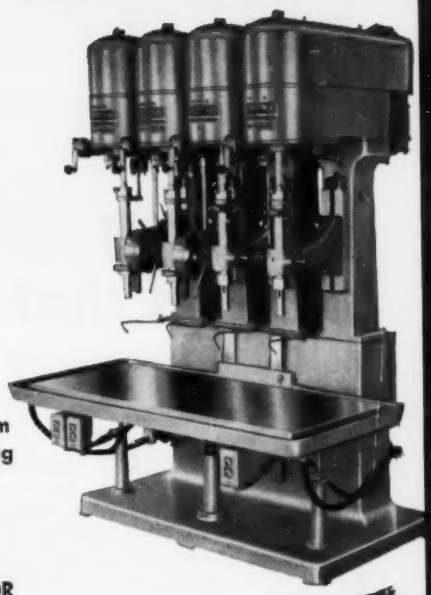
Infinite selection of speeds to 10,000 rpm

7" & 10" Overhang

⅜" Capacity

Pedestal and Bench models

Write for Bulletin 160



Edlund Model 2F

A top production machine for medium to heavy drilling and tapping.

Infinite selection of speeds to 3,600 rpm
8"–12"–15" Overhang
1¼" Capacity

Pedestal and Round Column types

Write for Bulletin 140R

America's Most Versatile Drilling Machines



Edlund Model 4F

A work-horse production machine for heavy duty drilling and tapping operations.

1¾" capacity with infinite selection of speeds to 2200 rpm
12" Overhang

Pedestal or Round Column Types

Write for Bulletin 170 R

NEW!

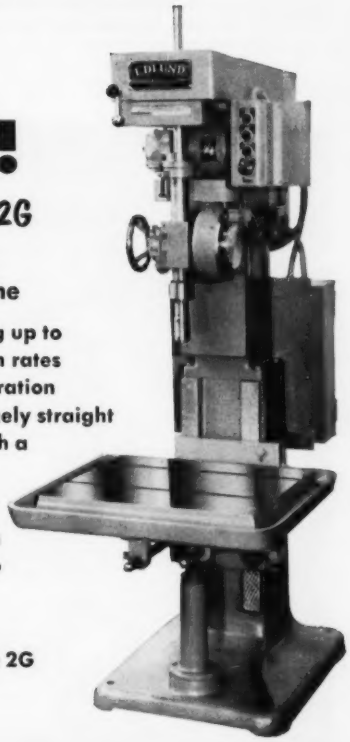
Edlund Model 2G

Vertical Gun Drilling Machine

Deep hole drilling up to 7½" at production rates in one single operation producing extremely straight smooth holes with a finish from 4-8 micro-inches.

⅝" Capacity with spindle speeds to 8000 RPM
12" Overhang

Write for Bulletin 2G



EDLUND MACHINERY CO. Cortland, New York

EDLUND REPRESENTATIVES IN MAJOR CITIES

Division of Harsco Corporation

NOW.. from MUELLER cold·prest® IMPACT

the amazing, new, chipless metalworking method that cuts production costs... ....improves part quality

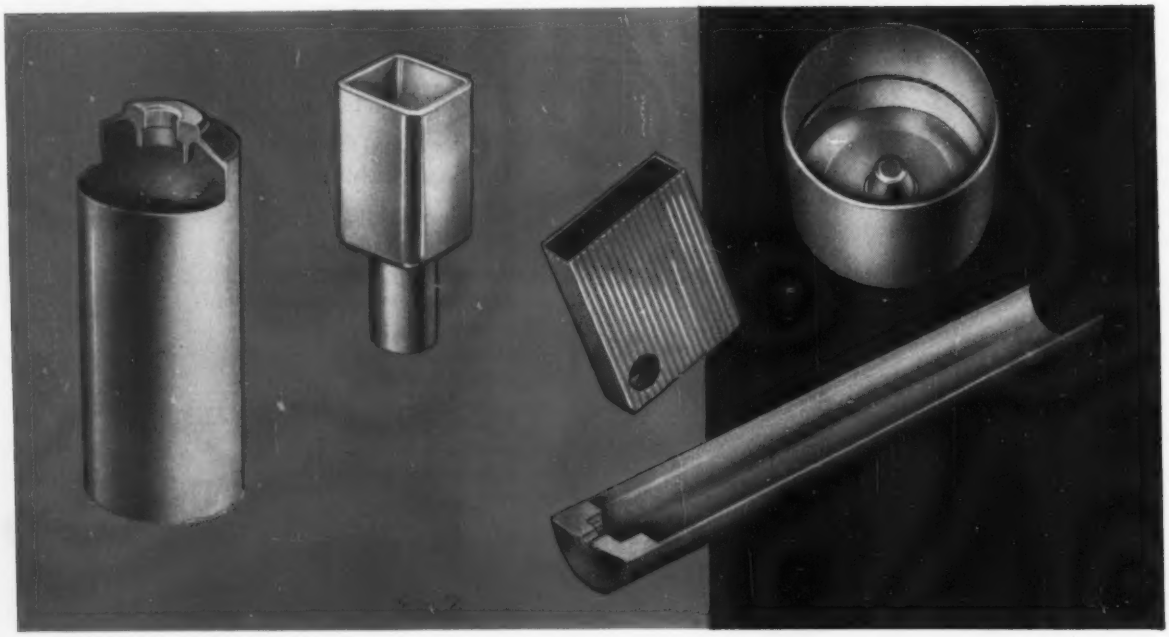
Cold-Prest Impact Extrusions are here. This amazing new method of producing parts to closer tolerances . . . with better physical characteristics, and with absolutely no waste and at extemely high speed is the greatest development in metal-working in the last 20 years. And it's proving to be the most practical method of manufacturing a staggering number of designs that combine cold forged bases with shells shaped as rounds, ovals or rectangles.

Here are some of the reasons why your company can save money and improve product quality . . . by specifying Mueller Brass Co. Cold-Prest Impact Extrusions. Parts are formed with *no chip loss;* you pay only for the metal that goes into the part. Because of the dimensional accuracy of Cold-Prest extrusions, parts can be held to closer tolerances and many costly secondary machining operations are eliminated. They have better physical properties with actually less metal needed to achieve greater strength.

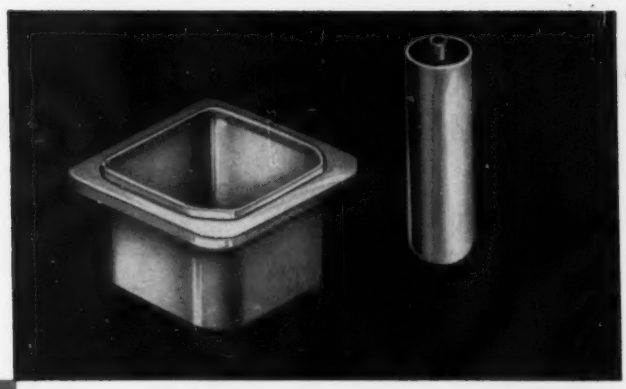
Cold-Prest Impact extruded parts often *reduce or eliminate assembly operations* because products employing several parts can often be made as a single extrusion. Also, complex parts produced by conventional methods requiring costly machining to close tolerances can be made in *A SINGLE OPERATION* as a Cold-Prest extrusion, saving raw material, costs of time, tools and labor . . . as well as assuring a positive leak-proof part.

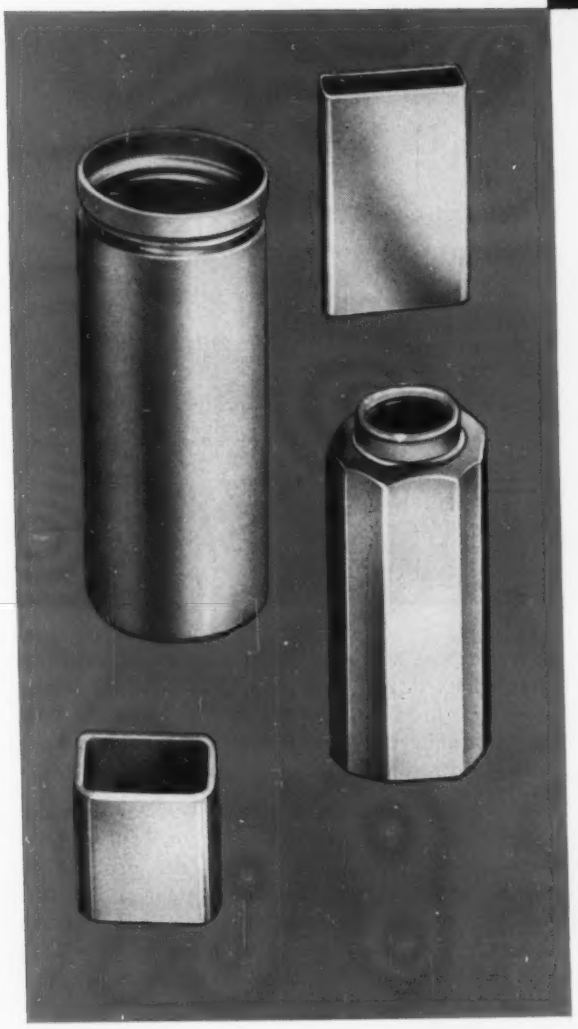


These are the outstanding reasons why you should consider Cold-Prest Extrusions when you are specifying and purchasing fabricated metal parts. Call a Sales Engineer from the Mueller Brass Co. . . . he will be glad to discuss your problems and answer your questions. Write today for our new 16 page engineering manual on "Cold-Prest Impact Extrusions".



BRASS CO.
EXTRUSIONS

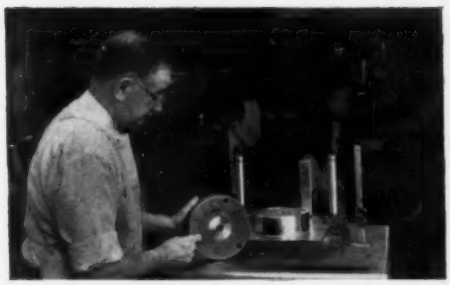




MUELLER BRASS CO. SERVICES mean better designed, better engineered, lower cost cold-prest extruded parts



To produce precision, high quality impact extrusions, Mueller Brass Co. combines all the important factors of design, engineering and production in its Cold-Prest extrusion process. Trained engineers take into consideration such elements as functional strength, finished appearance and proper control of metal flow. Mueller Brass Co. offers this design engineering service to its customers, and engineers are always available for consultation.



Here a die and punch assembly, made to exacting tolerances and with a mirror-like finish, receives a final inspection in the tool and die shop before being sent to the production department. Skilled craftsmen work with the best equipment available to produce these precision tools and dies. Technical skill, modern equipment and complete engineering services are available at no extra cost to you.

MUELLER BRASS CO.

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

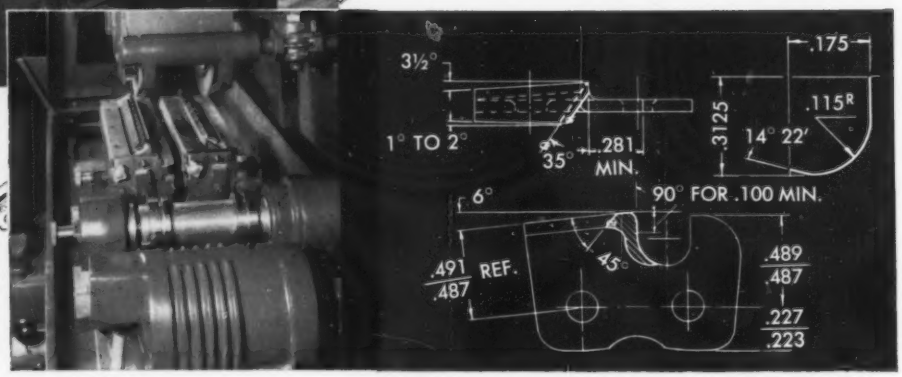
259

PORT HURON 27, MICHIGAN

Thompson TRUFORMING CUTS COSTS 60%







For 140 years, the policy of The Draper Corporation of Hopedale, Mass., has been to offer the highest quality product at the least possible cost.

Following this policy, its subsidiary, BlueJet Corporation, manufacturers of the famous BlueJet saw chain, installed a Thompson Truforming grinder to grind the cutting edges on their chain saw routers. These routers were formerly ground, piece by piece, by a force of 8 employees.

The Thompson Truforming operation is now cutting former grinding costs by 60%. 3 men only are now required for the operation. 40 L.H. and 40 R.H. routers are now ground simultaneously with one pass of the crush formed wheel, resulting in a day's production of over 12,000 pieces—many times that produced by the former method. Both the uniformity and sharpness of the routers have been greatly improved.

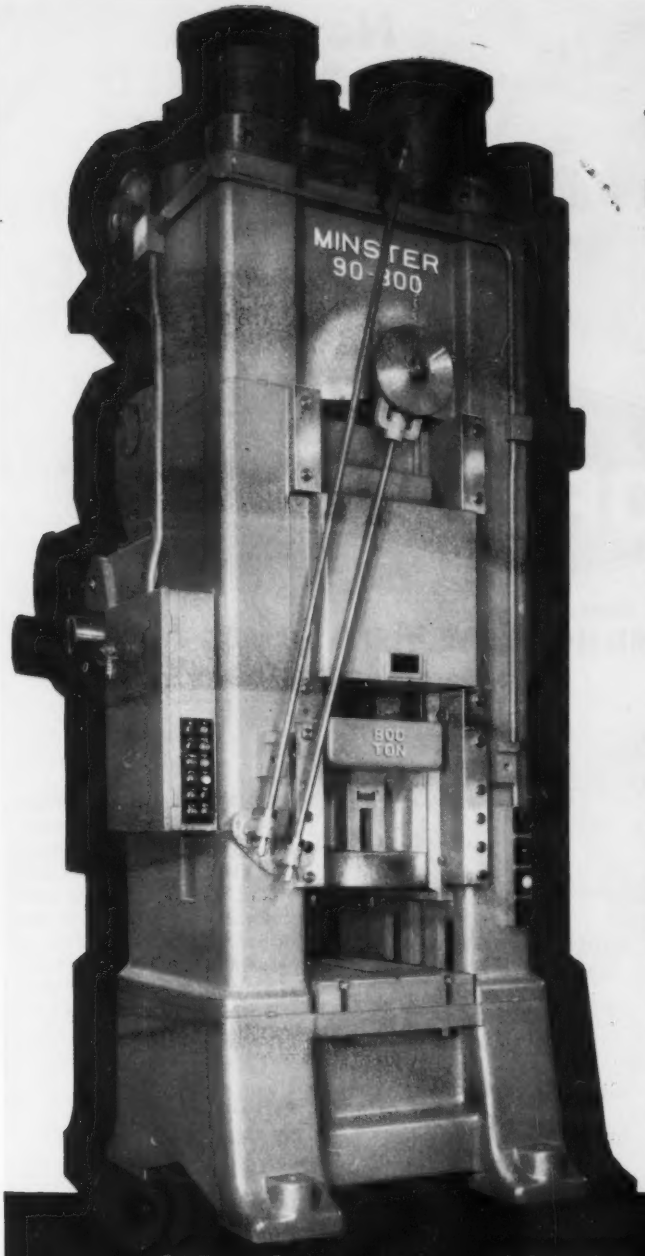
For 25 years, Thompson has pioneered and developed the modern advances in crush form grinding. If you have a time-saving, product-improving or cost-cutting problem in your operations, it will pay you to investigate the work Thompson Truforming grinders are now doing in plants all over the country. Our engineering experience is available to you without obligation. Write for Catalog T558.

"Keep Thompson in mind for the daily grind"

THE THOMPSON GRINDER COMPANY

SPRINGFIELD, OHIO

SURFACE GRINDERS



These Outstanding Features Make MINSTER® KNUCKLE JOINT PRESSES More Productive

- The Precision Built into the Press Gives You Greater Parts Accuracy—Longer Press Life
- More Single Stroke Operations per Minute
- Higher Speeds for Greater Velocity of Impact
- Positive Continuous Lubrication Provides Greater Precision, Reduced Wear, Less Maintenance
- Massive Frame and Tie-Rod Construction Withstands the Tremendous Forces of Knuckle Joint Press Work

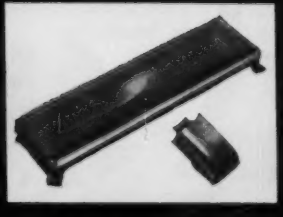
SIZING



COINING



EMBOSSING



THE MINSTER MACHINE COMPANY

MINSTER, OHIO



DETACHABLE MOTOR DESIGN
permits motor change in minutes
— avoids downtime for motor repairs.

Now - a MOTORIZED SPEED REDUCER FOR MOUNTING DIRECTLY ON SHAFT

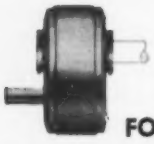
IT'S THE NEW OPTIMOUNT

Ratiomotor for shaft mounting. It's the compact power package you have needed to save space without sacrifice of top transmission efficiency. Single or double reduction helical geared units deliver 87.4 to 431 output RPM. Get details—find out how OPTIMOUNT can solve your drive design problems.

the NEW BOSTON Gear® OPTIMOUNT TRADEMARK

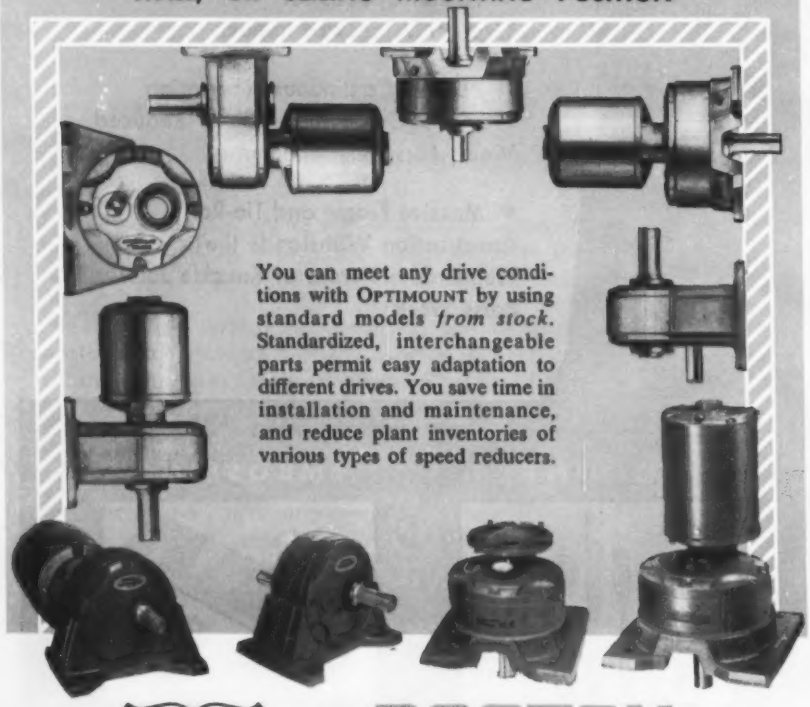
HELICAL GEARED

REDUCTORS • RATIOMOTORS AND FLANGED REDUCTORS



FOR SHAFT-MOUNTING . . .

OR IN STANDARD BASES FOR ANY FLOOR, WALL, OR CEILING MOUNTING POSITION



You can meet any drive conditions with OPTIMOUNT by using standard models *from stock*. Standardized, interchangeable parts permit easy adaptation to different drives. You save time in installation and maintenance, and reduce plant inventories of various types of speed reducers.

OPTIMOUNT delivers maximum power, with highest efficiency, through precision-finished helical gearing made to BOSTON Gear quality standards. Get details from your Distributor. He will demonstrate the many features that assure OPTIMUM PERFORMANCE. Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

66 MODELS
FROM STOCK

680 OPTIONAL MOUNTING ARRANGEMENTS

1/6 to 15 H.P. DRIVES

For nearest Distributor LOOK UNDER "GEARS" in the 'Yellow Pages'

CALL YOUR **DISTRIBUTOR** BOSTON Gear

NEW CATALOG OP-1 lists complete OPTIMOUNT data—selection charts, application information.



Remember — STANDARDIZATION PAYS —®

"in replacing equipment, we follow the advice we offer our customers"

STANLEY F. KRZESZEWSKI,
Vice President,
WHEELABRATOR CORPORATION,
MISHAWAKA, INDIANA.

"There is no room for sentiment or rule of thumb second guessing when we consider new capital equipment. We carefully examine the performance of existing machinery in terms of the MAPI equipment analysis formula. If we are convinced the new equipment will do the job better, faster, and cheaper, we buy it.

"In modern industry, obsolescence is based upon the new and improved methods of production that are available, rather than upon calendar years. Our new Wheelabrator Super Tumblast, for example, epitomizes our determination to provide industry with completely redesigned, cost-reducing, airless abrasive blast cleaning equipment.

"We are constantly endeavoring to help our customers to determine when a machine should be replaced. Each individual case is different, and many factors must be considered, such as: production capacity, projected cost of repairing and operating present equipment, present and anticipated business volume, interest on investment, quality of work, and salvage value of present machinery, to name only a few. We weigh these same factors carefully before reaching a buying decision.

"We encourage our customers to study carefully the engineering behind a piece of equipment from detail design to metallurgical properties of the materials used. We do the same when we consider new equipment. We do not sell Wheelabrator equipment on price alone. We are interested in marketing only field-proven equipment. We follow up with service to our customers and provide them with maintenance tips. We expect the same treatment when we purchase equipment.

"Only by being constantly on the alert can we be assured of having the manufacturing facilities that will permit us to turn out the products our customers deserve. If we are to help them do their production jobs better, faster, and more economically, we ourselves must keep pace with the many technological advances. A sound program of machinery and equipment replacement is thus one of the most essential functions of our manufacturing operation."

October, 1958

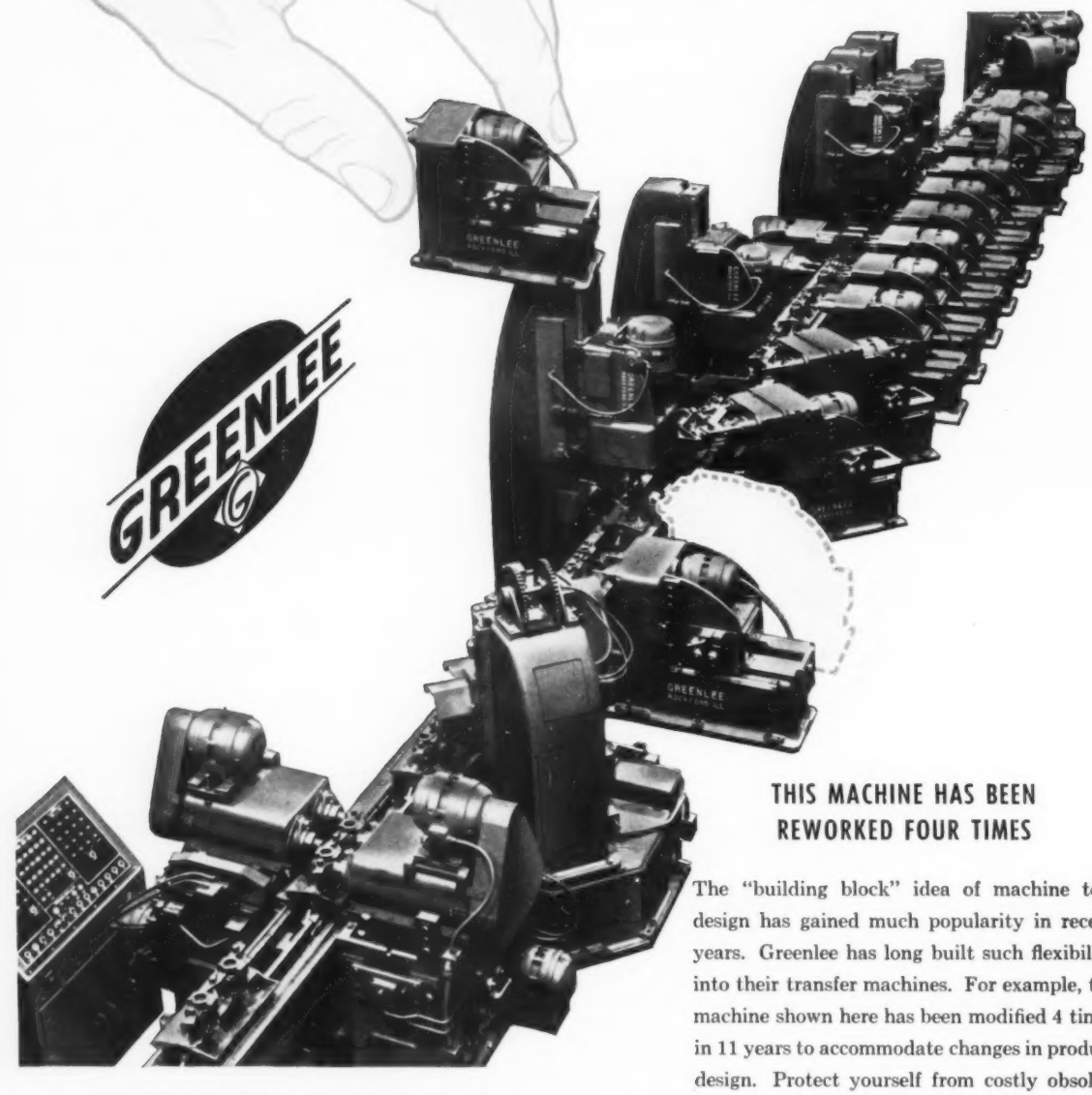
Rockford Insert Group



Keep gathering metal-working production ideas . . . be well informed when you replace machinery.

GREENLEE TRANSFER MACHINES

Change with Your Requirements



THIS MACHINE HAS BEEN REWORKED FOUR TIMES

The "building block" idea of machine tool design has gained much popularity in recent years. Greenlee has long built such flexibility into their transfer machines. For example, the machine shown here has been modified 4 times in 11 years to accommodate changes in product design. Protect yourself from costly obsolescence. Ask Greenlee to show you how.

PHONE ROCKFORD, ILLINOIS 3-4881
TO HELP SOLVE YOUR PRODUCTION PROBLEMS

GREENLEE
BROS. & CO.

1870 MASON AVE.
ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Are your lathes designed to profit from throwaway insert tools?

PROFIT POINT TURNING

Real profits come from decreased tool-change downtime and increased machine speeds

You can take full advantage of the savings made possible by throwaway insert tooling — elimination of sharpening and resetting costs, and decreased tool-change downtime — if you have a modern, high-speed lathe designed for carbides and ceramics. Chances are savings in tool-replacement costs plus greater production due to higher speeds and increased rigidity will amount to thousands of dollars a year, enough to pay for the new lathes you need badly to take full profit advantage.

The use of conventional speeds with throwaway insert tools is *wasteful.* And your profits are pegged *low* if you're using them on 20-year-old lathes that are underpowered for high-velocity turning. With perishable-tool costs so low in comparison with the cost of operating a lathe, the only sensible thing to do is boost machine speeds . . . burn up the cutting tool faster . . . really trim the fat out of the part price.

The speed at which tool costs and machining costs are in balance is your PROFIT POINT (see example above). But to operate at the right speed you need power, precision, and rigidity in lathes used with throwaway insert tooling—advantages your company will be glad to pay for in order to save time, floor space, and cost.

In other words, why put throwaway insert tooling on a "throwaway profit" machine tool?

Example of PROFIT-POINT Turning

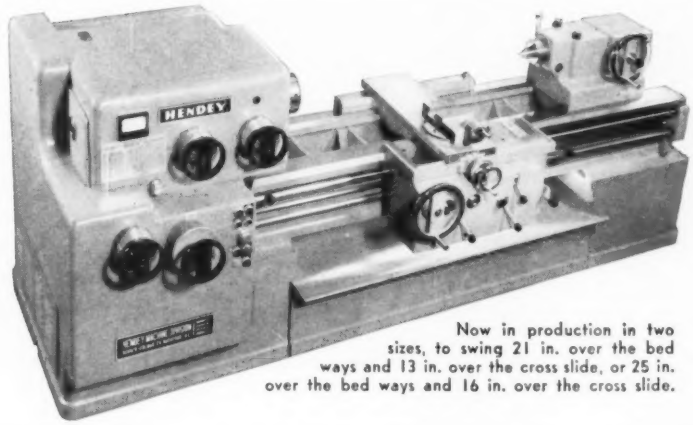
Cost Item	Brazed Carbide	Throwaway Insert
Tool-change time	5 min.	2 min.
Cost per cutting edge	$1.27	$.25
Minimum cost tool life	40.4 min.	11 min.
Cutting speed for PROFIT-POINT turning	720 fpm 1000 rpm	980 fpm 1360 rpm
Machining time per piece	1 min.	.74 min.
Total time per piece (including nonproductive time per piece)	2 min.	1.74 min.
Machining cost per piece	$.15	$.11
Total cost per piece	$.031	$.017
Nonproductive cost per piece	$.15	$.15
Pieces machined per hour	30	34
TOTAL COST PER PIECE	$.331	$.278

Barber-Colman's new 36-speed lathe is designed for PROFIT-POINT turning

Here's the machine that will give you precision work at the high speeds required for PROFIT-POINT turning with throwaway insert tools!

Look at the cross girth of the bed, extra-heavy cross slide, and rugged tailstock. Consider that this lathe will pull up to 25 hp through the spindle and operate at speeds up to 2000 rpm — yet you can get toolroom accuracy. And all the toolroom features, too, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 threads, from 2 to 120 per inch, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to half nuts.

There are 36 spindle speeds through the geared head and 66 feed and thread changes, selected easily through two dials on the headstock. Write for complete facts on how this new Barber-Colman precision lathe will pay for itself quickly with throwaway insert tooling.



Now in production in two sizes, to swing 21 in. over the bed ways and 13 in. over the cross slide, or 25 in. over the bed ways and 16 in. over the cross slide.

Barber-Colman Company
102 Loomis Street, Rockford, Illinois

Don't expect a day's work for a day's pay on yesterday's machine tools

BARBER COLMAN ®

PRECISION LATHES

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

HOW TO GET A QUICK, HIGH RETURN FROM YOUR INVESTMENT IN NEW PRODUCTS AND SALES



"Mattison-equipped" subcontract shops can cut new product lead time, increase quality, reduce costs

Are product design, tooling, or production problems slowing your "operation upswing"? If so, why not take advantage of the facilities and skills offered by contract shops like Standard Tool & Manufacturing Company, Kearny, New Jersey.

This 45-year-old firm is excellently equipped for precision machining on Mattison high-powered precision surface grinders and offers complete production facilities with expert technicians to help you get new products on the market faster, at lower capital investment risk.

Typical of the benefits to you is this company's recent acquisition of a Mattison No. 36 vertical-spindle rotary surface grinder, a machine that increased Standard's grinding capacity 20 per cent. Accuracy, too, has taken a big boost. Standard estimates the improvement at about 25 per cent—can now "guarantee" parallelism of .0002 in. on some jobs.

The ability to handle large and small work efficiently on a high-powered surface grinder gives Standard's customers higher values in purchased work. Operations are not limited to finishing. Rigid Mattison machines can take off stock on a profitable production basis—grinding sides, angles, and complex forms to close limits with a fine surface finish that improves product appearance and quality. They grind larger surfaces better, with no vibration or chatter, requiring minimum wheel "tilt" for truly flat machining.



Armor plate is the material used for phonograph record molds. Finish and parallelism are important because the master will pass errors on to the pressings. The Mattison grinder more than meets this test of precision.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

If your new product is "bottlenecked" by engineering or production problems, why not benefit from the "outside thinking" and excellent capabilities of a "Mattison-equipped" subcontract shop? It may be the fastest and best way to get a profitable return from your investment in new product development and sales!



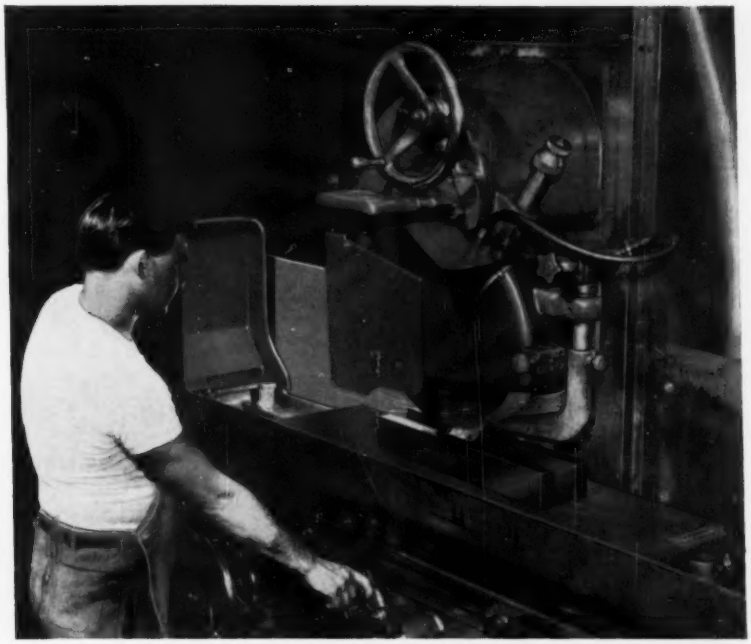
Heavy parts of all types are loaded and unloaded on the Mattison with ease. Machine has the power needed for rapid stock removal often required on big jobs. Centralized control reduces operator fatigue and rejects.



Short run with extreme precision characterized a recent job of grinding 12 molds for pressing phonograph records. The material was armor plate with stock removal of .375 on one workpiece, and .350 on the other. Flatness is held within .002 in. after brazing and finish grinding.



General offices and primary manufacturing facilities of Standard Tool & Manufacturing Company are located at Kearny, N. J. Another plant in Lyndhurst, N. J., headquarters their engineering, assembly, and development operations.



Precision machine parts are ground on the Mattison horizontal-spindle surface grinder, which easily holds parallelism, flatness, and size within extremely close limits.



High production and precision are both required on this job of grinding small metal jaws used in precision subassemblies for machinery made and marketed by Standard. Machine grinds 100 pieces at a time . . . thin section needs proper speed, feed, and wheel pressure.

HOW CAN SUBCONTRACT GRINDING HELP YOU?

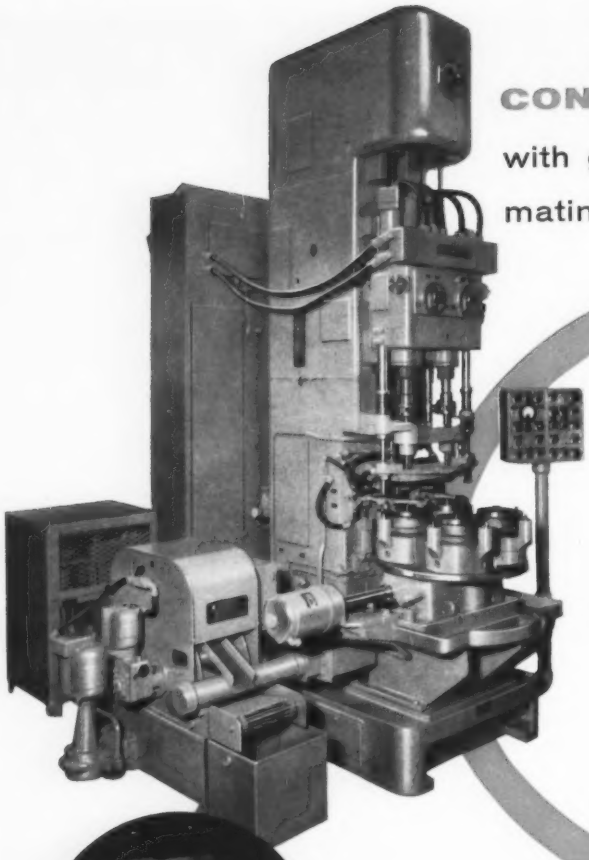
Hundreds of "Mattison-equipped" shops are ready to tackle your difficult machining problems. They can grind almost any flat piecepart efficiently and fast, with a fine, accurate surface finish. Switch to production surface grinding . . . save time and money.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

HIGH-POWERED PRECISION SURFACE GRINDERS



FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

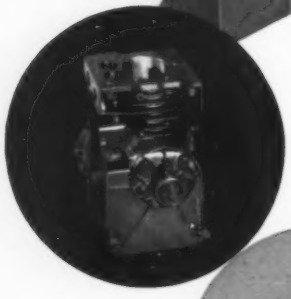


CONTROL PARTS INVENTORY

with guaranteed **single-size** mating parts

Barnesdril honing control eliminates size differences (tenths) between bores;

guarantees one-size finishing







BarnesdriL honing machines with controlled sizing automatically establish positive limits on cylinder bores, connecting rods, gears and other mating parts. Because single size is guaranteed bore-to-bore through Plugmatic Sizing, production of mating parts is simplified and inventory is held to a minimum.

The inherent capacity of BarnesdriL Honing to hold bore tolerances precisely, and guarantee single size bore-to-bore, reduces both operating and inventory costs. Ask for production estimates on your bore finishing operations. A BarnesdriL engineer will be glad to call.



New bulletin no. 550

completely describes controlled size, finish and accuracy with BarnesdriL Honing. Write for a copy.

BARNES DRILL CO.

830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

W. F. & JOHN BARNES

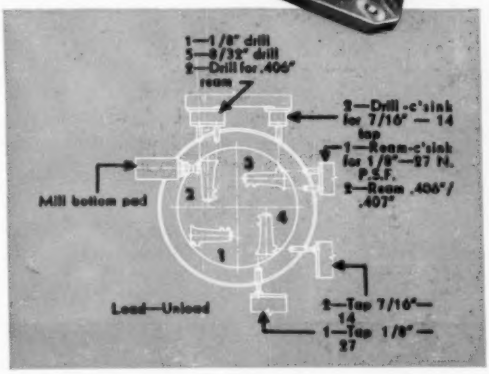
4 station special

HANDLES 17 MACHINING OPERATIONS, SAVES FLOOR SPACE

Here is another cost-cutting example of a special machine engineered by W. F. and John Barnes that provides both an efficient machining method and the means to save valuable floor space. A total of 17 operations on the cast aluminum transmission housing, illustrated at right, are performed at a gross production rate of 118 pieces per hour. Operator handles both loading and unloading while parts are processed at the three machining stations. A 48" diameter hydraulic table indexes the work from one station to another. Compactness of the machine's design conserves floor space, yet ample room is provided for easy accessibility to working heads.



Cast aluminum transmission housing



Builders of Better Machines Since 1872

W. F. & JOHN BARNES

ASK FOR AN ANALYSIS OF YOUR MACHINING METHODS — For assistance with machining problems ask a Barnes Engineer to work with you. Ask for a copy of "Coordinated Machine Engineering" — tells how Barnes 6-point machine building service saves time, eliminates divided responsibility.



W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET • ROCKFORD, ILLINOIS

Multiple Spindle Drilling • Boring • Tapping Machines • Automatic Progress Thru Transfer-Type Machines

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



NEW **HYDRAULIC** SLOTTER OFFERS BOTH

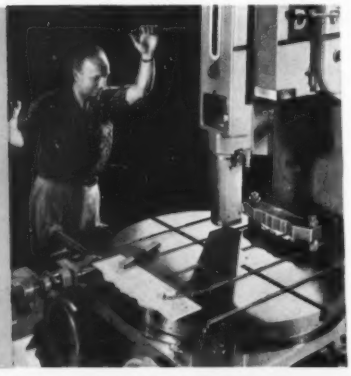
tracing and conventional slotting

Here's a powerful new Hy-Draulic Slotter capable of doing both conventional slotting and complicated tracing work. Rotary tracing and straight work are handled by a transverse movement of the saddle. Equipped with a highly sensitive, precision-engineered Kopy-Kat Duplicator, this slotter will actually produce its own working templates from a toolroom master, or from a finished workpiece.

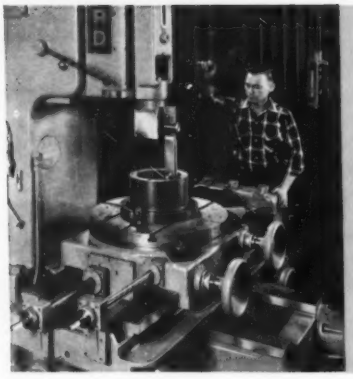
Design features of this versatile new machine include powerful fulcrum drive to the ram, hydraulic feeds and power rapid traverse in all directions, and pendant controlled cutting speed changes.

See your Rockford Machine Tool Co. representative, or write us directly, for the complete information on this new Hy-Draulic Slotter.

tracing

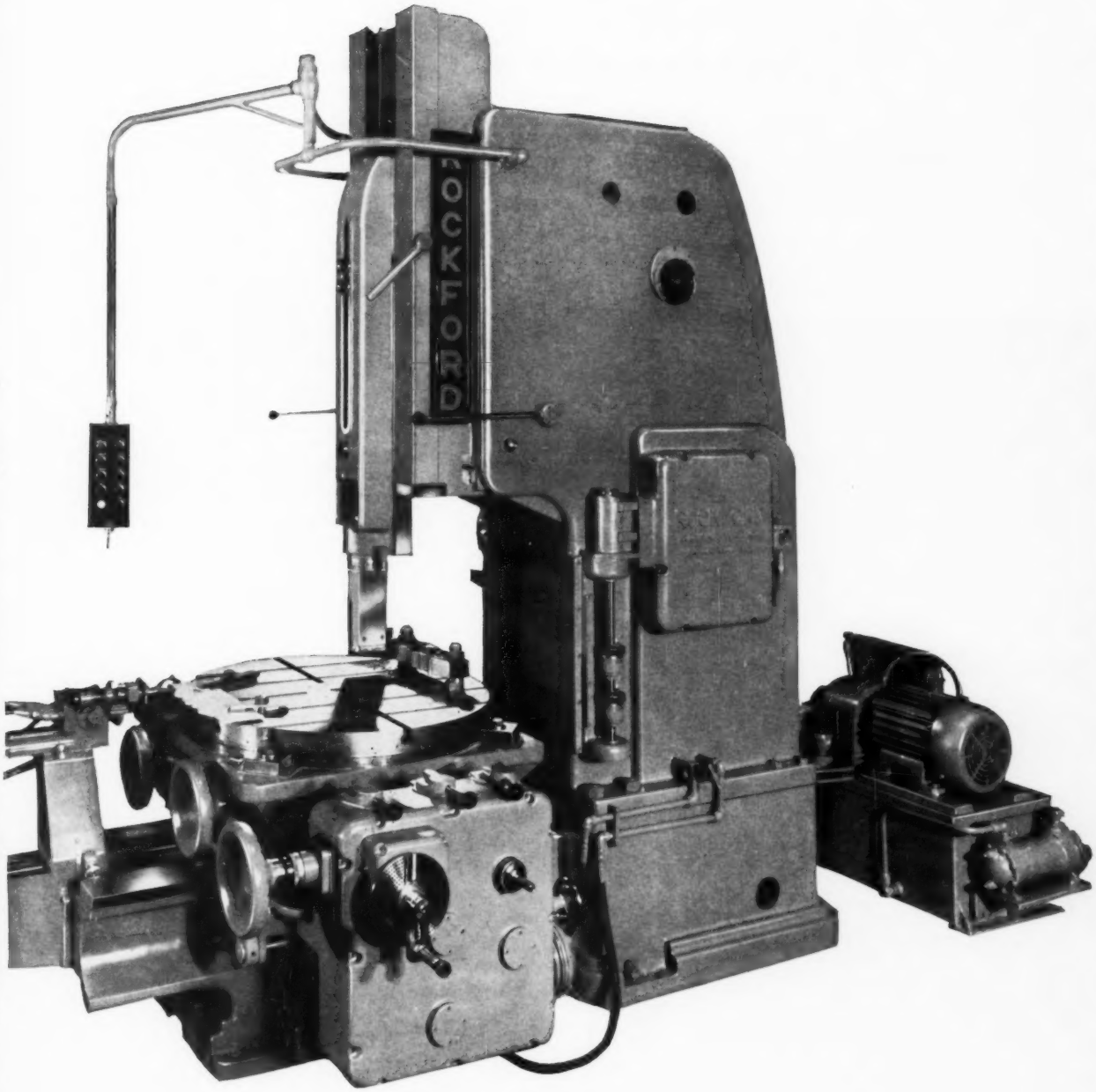






conventional slotting

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

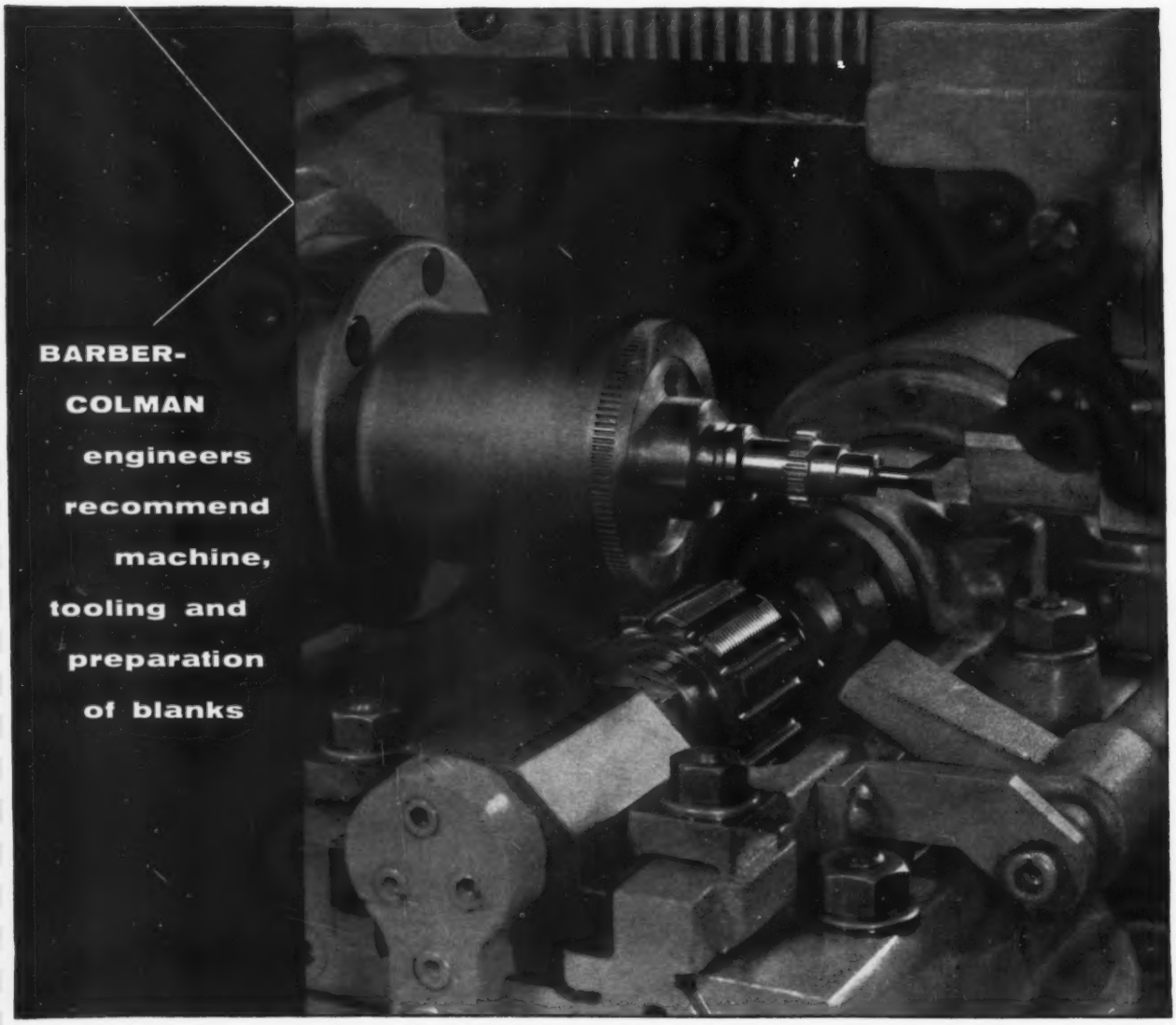


ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS ROCKFORD, ILLINOIS, U.S.A.

GUARANTEED ACCURACY
with standard-type precision hobbing machines



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



The Kearney and Trecker Corporation have designed a servo-control mechanism for controlling an airframe section profile and contour milling machine. The extreme accuracy required for the transfer of motion in this mechanism demanded a whole new approach to the production of gears at Kearney and Trecker.

Barber-Colman Engineers were consulted for their suggestions to assure gear accuracy for this program. They recommended a standard-type No. 6-10 Precision Hobbing Machine and designed special tooling for each of the eight gears in the mechanism. They also specified the preparation of the blanks for hobbing.

This machine is guaranteed to cut a 4″ diameter spur gear within .0002″ adjacent and .0004″ non-adjacent spacing error checked on an optical dividing head. The blanks are ground on the diameter and sides, holding the diameter, parallelism and radial and axial runout within .0001″. Two holes are provided for driving the gear during hobbing.

These photographs show one of the gears in the train and the special tooling designed for it. The blanks are located between centers and are driven by a diamond-shaped pin in the backing plate. For hobbing this 48 D.P., 115 tooth gear, a feed of .010″ is used, and the hob speed is 183 R.P.M. The material is stress-proof steel R.C. 27. Barber-Colman Class AA taper-bore hobs are used and resharpened to original hob accuracy on a Barber-Colman No. 6-5 Hob Sharpening Machine.

With this equipment and recommended procedure, all gears in the train are hobbed well within Precision Class 2 AGMA tolerances. The success of this program is indicated by the results obtained on the example shown. Inspection shows these gears are consistently within .0002″ tooth-to-tooth and .0004″ total composite error.

Accuracy of this degree is not unusual with Barber-Colman machines and hobs. This case shows the results which can be obtained by working closely with, and following the recommendations of, experienced hobbing technicians. When you have applications requiring accurate gears, consult Barber-Colman hobbing experts for their recommendations.

BARBER-COLMAN COMPANY

6210 ROCK STREET • ROCKFORD, ILLINOIS

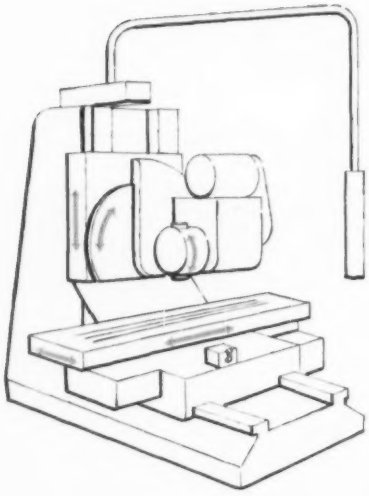
Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

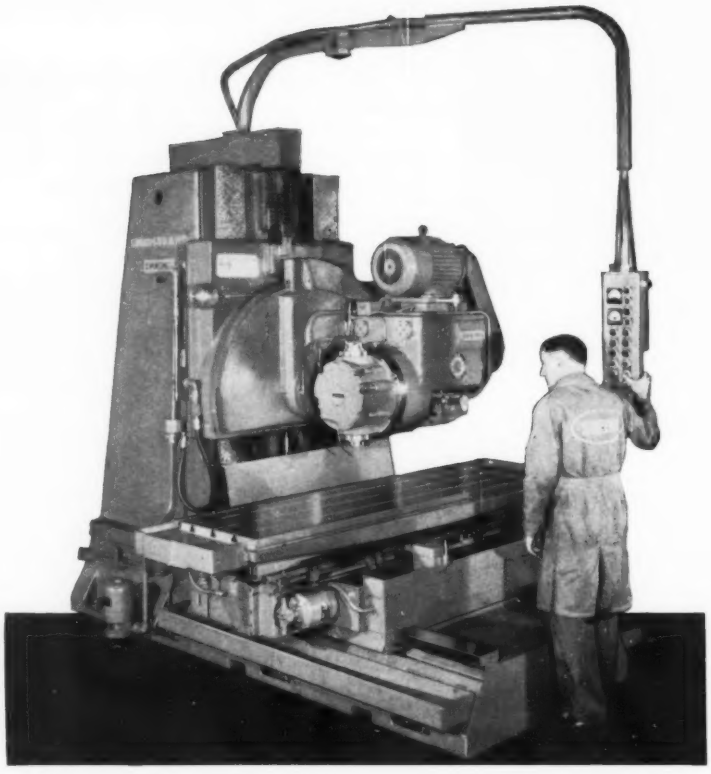
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

NEW SUNDSTRAND OMNIMIL

...machines at any and all angles!



New Omnimil is a precision five axis machine tool with possible directions of movement and adjustment indicated by arrowheads on sketch above.



This new Sundstrand machine combines the rigidity of a heavy duty milling machine, the versatility of an all-angle head and the range of a boring mill. That's outstanding flexibility and work capacity in a single machine. It can handle milling, boring and drilling operations on ferrous and non-ferrous parts in an almost unlimited range with outstanding precision and minimum work handling because spindles are adjustable to any angle. A 15 hp double spindle head offers both a low speed range from 25 to 400 rpm at one spindle and a high speed range of 250 to 4000 rpm at the second spindle. Both spindles have quick speed change.

Power feed rates are infinitely variable between ½ and 200 inches per minute for longitudinal and transverse feed and ¼ to 100 inches per minute for vertical feed. Pendant control in increments of less than .001 inch is provided for setup. No other machine offers anywhere near the flexibility and production capacity available in the Omnimil. With the Omnimil fewer set-ups are required and consequently less expensive fixturing. Positive clamping of machine members without distortion of location is the Omnimil feature that permits outstanding accuracy in performance.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS | TRIPLEX RIGIDMILS | SPECIAL MACHINES

SUNDSTRAND "Engineered Production" Service"









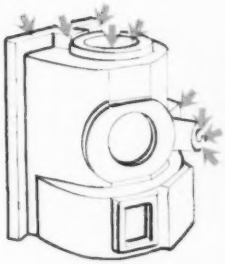


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

See for yourself . . .
how the Omnimil's versatility pays off in performance . . .

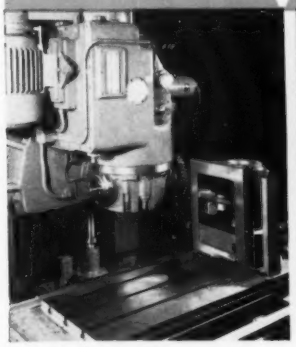
Six of the 15 operations on a housing part are shown below. All 15 operations are done in two set-ups . . . only *one* relocation of the part.

Because all the work can be handled on one machine, the capital investment and the number of skilled operators required are held to a minimum. Instead of several machines lightly loaded, one machine is kept working near its rated capacity.



Arrowheads indicate surfaces machined with part vertical.

VERTICAL POSITION



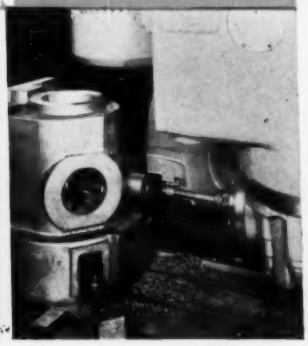
Operation No. 1 —

Profile milling bottom of housing also provides locating surface for part during second set-up. Head in position No. 1.



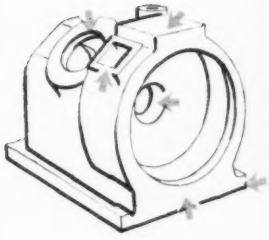
Operation No. 5 —

Profile milling cover pad. Note that smaller tungsten carbide cutter is used and head is now in position No. 3.



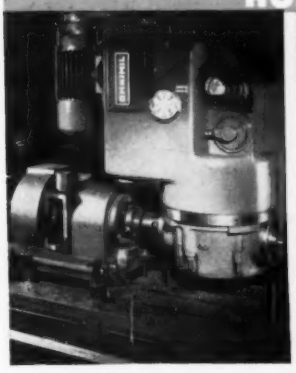
Operation No. 8 —

Finish bore 1" diameter hole in boss. Boring operations are performed on the Omnimil with outstanding precision.



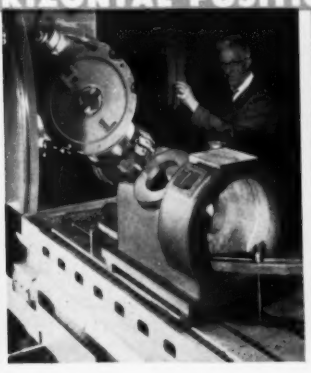
Arrowheads indicate surfaces machined with part horizontal.

HORIZONTAL POSITION



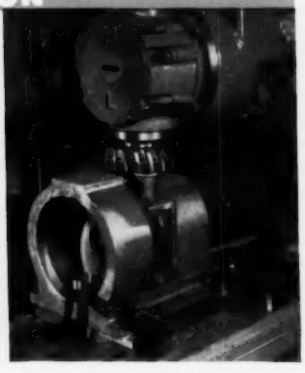
Operation No. 11 —

Rough bore 5" diameter in end of housing using tungsten carbide boring head with Omnimil head in position No. 5.



Operation No. 14 —

Milling second of two angular pads with 9" diameter cutter. Precise angle needed is set quickly and accurately. Head is in position No. 6.



Operation No. 15 —

Final operation consists of milling the pad on top of housing with same milling cutter as in previous operation but with head in position No. 2.

Both a larger version of the 15 hp Omnimil and a 50 hp vertical Rigidmil with three directional feed are among the newest ideas in universal machines available from Sundstrand. All three machines are described in Bulletin 696. Write for your copy today.



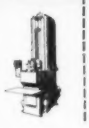
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2530 ELEVENTH ST., ROCKFORD, ILLINOIS

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The ACKNOWLEDGED AUTHORITY of the METALWORKING INDUSTRIES

For forty years . . . through fourteen editions . . . with over a million copies sold, MACHINERY'S HANDBOOK has been the indispensable reference book for designers and builders of mechanical products. Now the 15th Edition, with over 400 pages revised and brought up to date, gives you the latest and most authoritative information on present-day designing, manufacturing and metalworking practices.

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MACHINERY'S HANDBOOK contains 1911 pages of mathematical and mechanical tables, rules, formulas and general data (see complete table of contents on page 3). Its "math" and other tables never subject to change are accurate to the last decimal point, because Handbook users all over the world have been checking them for 40 years.

How Far Back Are You in the Handbook Parade?

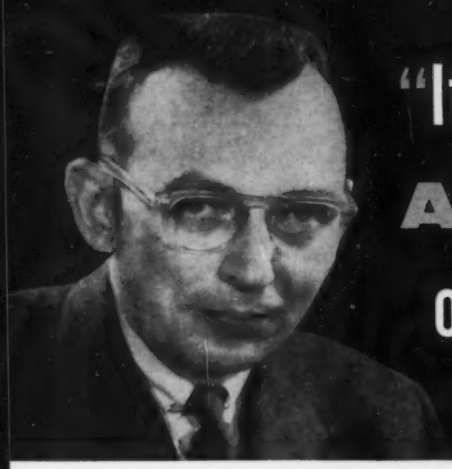
Does your present Handbook give you *today's* answers? The 12th Edition of MACHINERY'S HANDBOOK was published in 1943—only 12 years ago—but . . . 474 pages were revised and 96 pages were added to provide new material for the 13th Edition in 1946. Then . . . 290 pages were revised to provide new material for the 14th Edition in 1949. And now . . . 432 pages have been revised to make the New 15th Edition better than ever and ready to help you tackle the problems of today.

MACHINERY'S HANDBOOK meets this need whether you are a designer, a machinist, a mechanical engineer, a student, a production executive, an apprentice, or an inspector.

Write for your copy of MACHINERY'S HANDBOOK today. If you send payment with your order, we pay postage and handling charges. Your money will be refunded if you decide not to keep the Handbook. Or, if you wish, we will send it to you under our Five-Day Free Examination Plan; you pay only after you have seen and used the Handbook, and discovered how much it can help you in your work.

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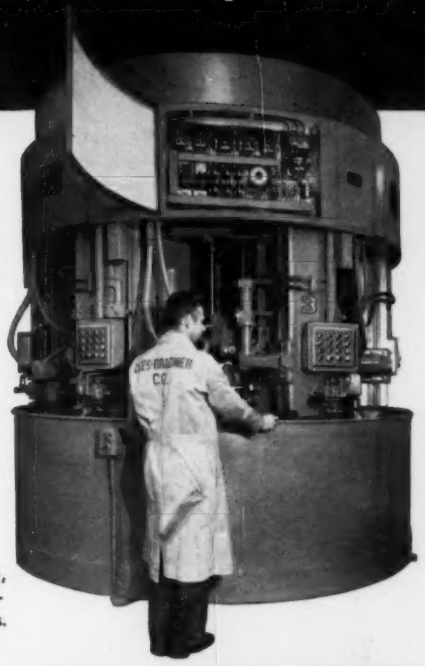


"If we stick to ALLEN-BRADLEY... our control troubles evaporate"

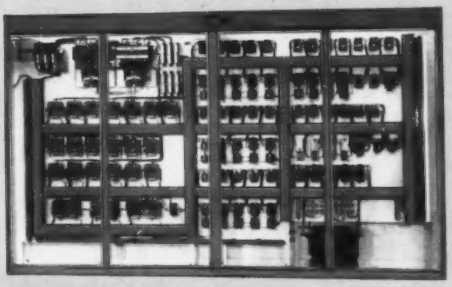
...so says John A. Bradner,
President, Lees-Bradner Co.,
Cleveland, Ohio, machine tool manufacturer.

"Yes, we have chosen Allen-Bradley controls. We use them, like them, and most thoroughly approve of them. We do our level best to see that they're the ones with which LEES-BRADNER machines are equipped.

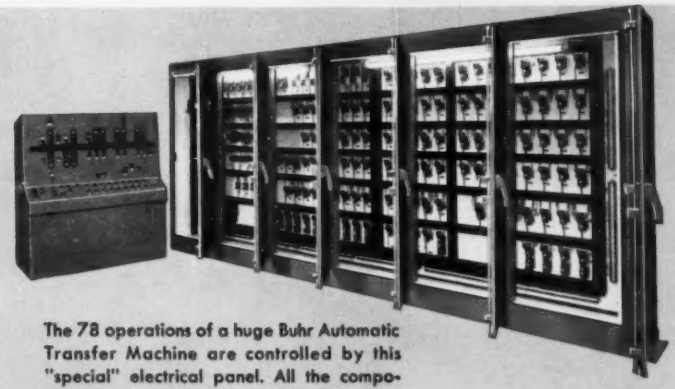
"It has been our experience in over 25 years of pioneering electrical rather than mechanical control of machine tools that, if we stick to Allen-Bradley, control troubles we are too apt to have otherwise—*evaporate!*"



Lees-Bradner Gear Hobbing Machine, above, uses six motor control panels assembled from standard A-B components.



This is the electrical control panel for a 12-station Kingsbury Indexing Automatic which performs 19 operations on an automatic transmission part. All the components in this panel are standard A-B control items.



The 78 operations of a huge Buhr Automatic Transfer Machine are controlled by this "special" electrical panel. All the components are standard Allen-Bradley units.

A-B QUALITY

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

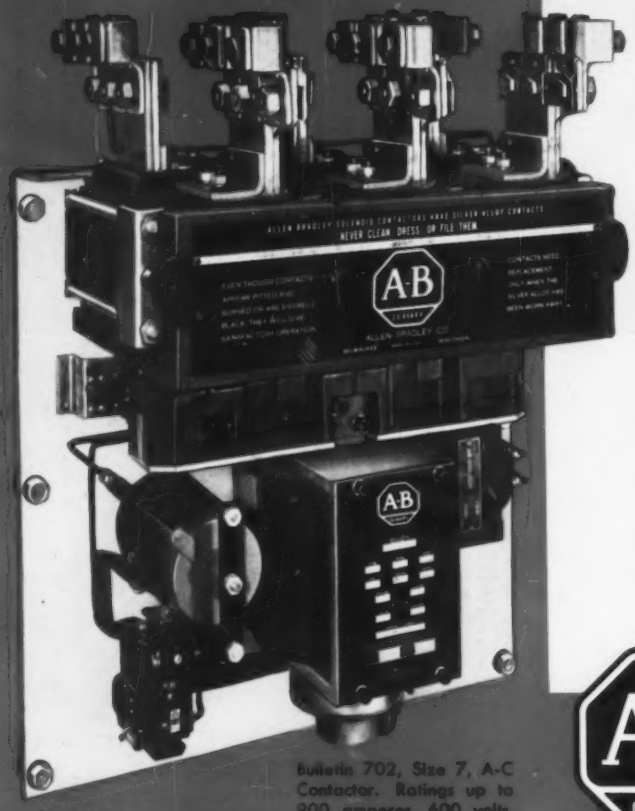
10-58-B

only

ALLEN-BRADLEY gives you Trouble Free Solenoid Starters in ALL SIZES!

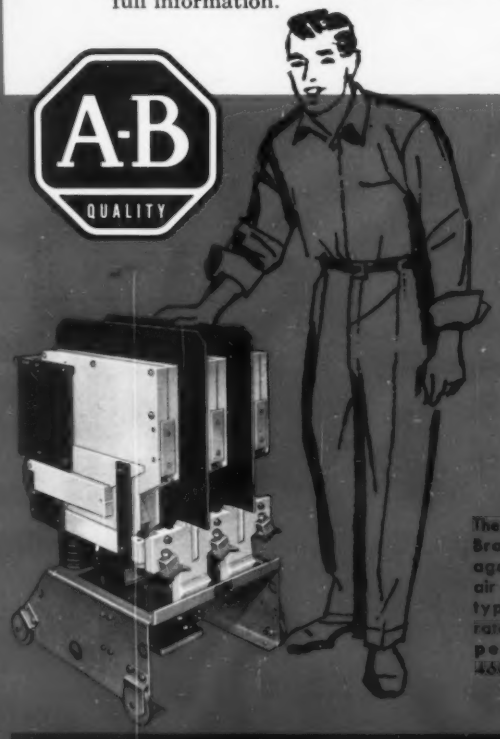
The simple solenoid design—exclusive with Allen-Bradley in the big starter sizes—has only one moving part. This eliminates the trouble causing bearings and flexible jumpers of conventional clapper switches . . . and assures millions of trouble free operations. A-B solenoid starters also have double break, silver alloy contacts that never need any servicing. They are always in perfect operating condition—until the contact is completely used up.

This time-tested solenoid construction is available on *all* Allen-Bradley starters up through Size 7 . . . as well as on A-B's rugged, air break, high voltage starters. Write for full information.

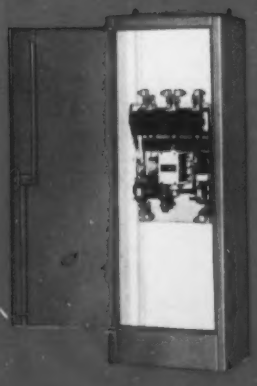


Bulletin 702, Size 7, A-C Contactor. Ratings up to 900 amperes, 600 volts. This basic solenoid contactor is used in large A-B low voltage starters.

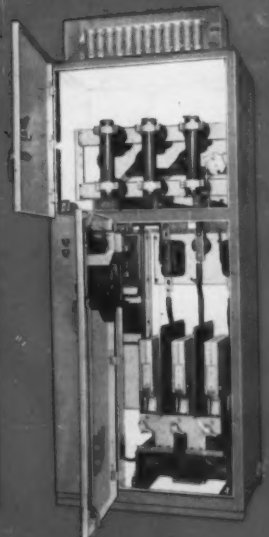
A-B QUALITY



The heart of Allen-Bradley high voltage starters is this air break, solenoid type contactor—rated at 400 amperes, 2300 or 4600 volts.



Bulletin 709 across-the-line solenoid starters are made in ratings to 300 hp, 220 v; 600 hp, 440-550 v.

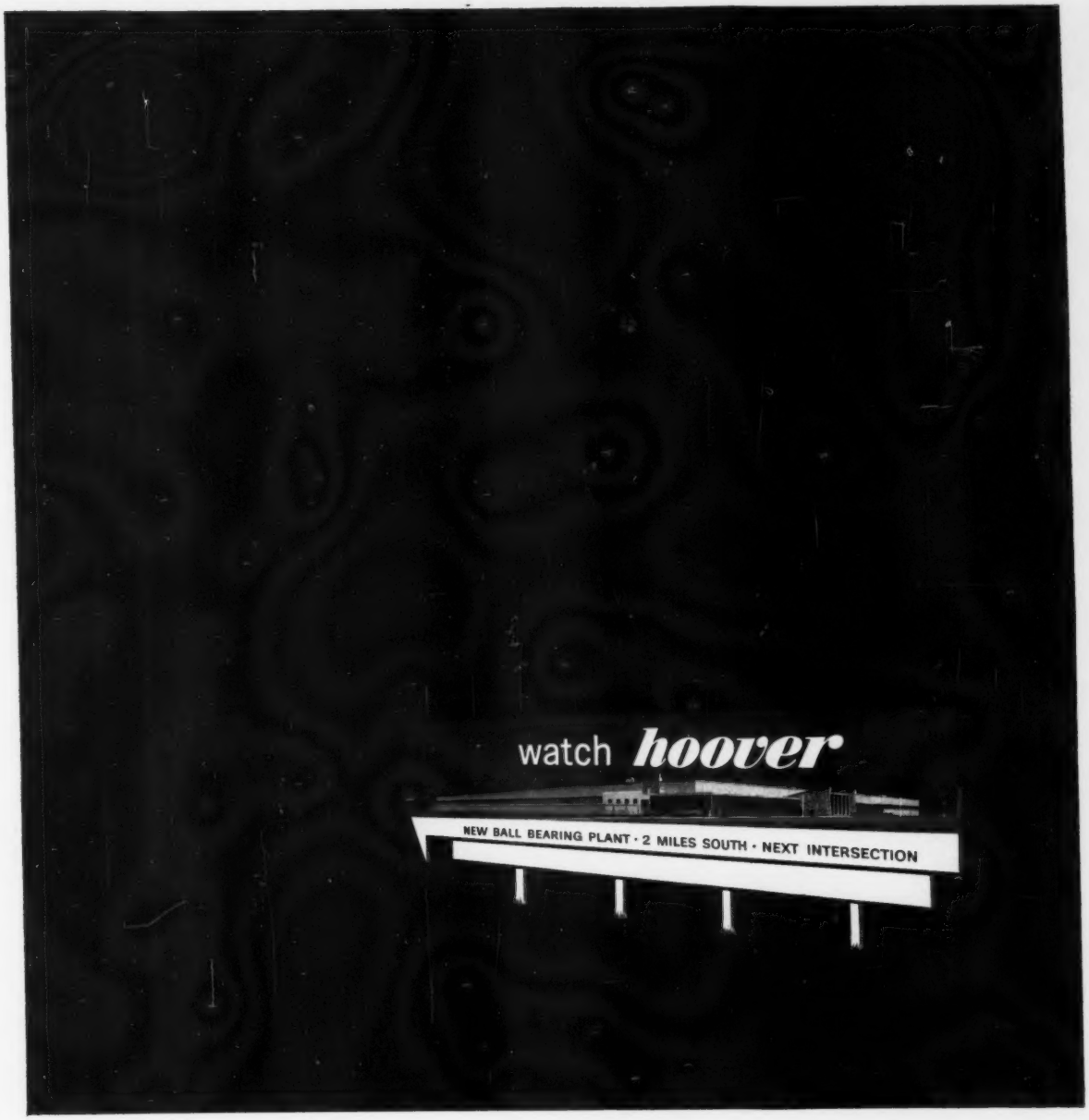


A-B high voltage starters are built for all types of motors. Ratings to 1500 hp, 2300 v; 2500 hp, 4600 v.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

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10-58-MR



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letters from production men . . .



Thread grinders serve as research tools

The versatility of Jones & Lamson Thread Grinders is hardly tested in the conventional production of hobs, taps, gages and threaded parts. In our toolroom, using the thread grinder as a basis for "Rube Goldberg" development we have produced precision racks, small form-profiled milling cutters, oil grooves and grinding wheel crushers.

While serving the purpose as a necessary piece of equipment, it also provides a platform from which solution-seeking thoughts may be launched in determining many additional production problems. The application of the thread grinder to toolroom problems is putting the best foot forward in achieving quick, accurate and dependable shop accessories.

— Production Specialist —

One machine replaces three

Our Jones & Lamson #5 turret lathe equipped with tracing attachment is doing the work formerly done by three conventional turret lathes. This Jones & Lamson machine does the rough and finish bore on a 6.5 diameter, 10.0 long magnesium ring. There are nine bore diameters, eight shoulder dimensions, all held to close tolerances. The accurate repetition and smooth operation of this machine reduces operator strain and produces better parts.

In our operation, full utilization of machine tools is a must. We appreciate our Jones & Lamson in helping to attain these goals.

— Assistant Superintendent —

Not afraid of competition

When the bids and quotations are opened, it's the shop with the J & L tools that gets the business. J & L turret lathes are the backbone of our job shop. Over 80% of our work is composed of machining the various alloys of stainless steel. J & L's speed, feed, power and rigidity coupled with your rapid traverse makes it possible for us to undertake jobs that our competitors wouldn't think of attempting, unless they too have J & L tools.

The availability of a J & L factory trained representative is an intangible asset to us. There isn't another machine tool builder in our area that has this service so readily available. Time and again his courtesy calls, at no expense to us, have resulted in the solving of production problems.

— Owner —

Accuracy is a "must"

We have used Jones & Lamson equipment for 17 years. In the past six months I have been partly responsible for replacing some of the turret lathes. One feature that makes Jones & Lamson our choice is the versatility possible with the 5" chuck opening.

Our principal reason for choosing Jones & Lamson again is that its rigidity and accuracy can be thoroughly depended upon for internal and external boring. The satisfaction of knowing that the close tolerances required *will* be held is vastly important in the production of our aircraft parts, because it cuts to the minimum the spoilage and rejection of parts and manhour costs.

With our future program of jet aircraft and missiles, these factors are even more important than formerly. Close tolerances and the fitting of mated parts are an absolute necessity, and we feel sure that Jones & Lamson machines will give us quality and quantity of parts to meet our requirements.

— General Foreman —

Straight from the shoulder

I am a man that came up the longest and most interesting way. Apprentice, turret lathe operator, toolmaker, Sub Foreman, Turret Lathe Foreman, Gen. Foreman, Gen. Supt. and I think I know what I am talking about. I will tell you guys in plain shop language, the best damn feature of one of the finest turret lathes built — now hold your breath. This is it. The J&L Preselector.

Features:

#1 The best design. Past, Present, and Future. You were right the first time. No design change.

#2 Ease of training apprentices and future supt's.

#3 Safe to operate. No broken backs or torn shop coats.

#4 Less motion than any other design. Means no wear, no maintenance, no down-time. Hours x man's time + burden = Dollars saved.

#5 No personnel problems, as long as you let them operate the machine with the simple preselector.

P.S. We have saved 35% with our new #5 tracer.

— General Superintendent —

The lady has a point

When we order Jones & Lamson machinery, my desk is never cluttered with unnecessary paper work. The precision, durability, and dependability of your equipment keep repairs and breakdowns to a minimum, thus saving precious time and tedious work.

Jones & Lamson machinery is help we can rely on with confidence.

— Production Secretary —

A few words from Texas

Texas is predominantly an agricultural state, and as such, raises farmers and ranchers rather than mechanics. However, it is rapidly becoming an industrial state. But — and here is the catch — farmers and ranchers are not very good machine operators.

Short runs predominate in our industry, and short runs call for turret lathes. The Jones & Lamson Hydraulic Tracing Attachment can make turret lathe operators out of farmers and ranchers in a very short time.

— Procurement Engineer —

No strain — no pain

The advanced progress in cutting tools has created a challenge to the machine tool industry. One of your answers is a heavier headstock, a heavily ribbed bed, and a rigid universal bridge carriage (supported on front and rear bed ways).

For instance: — Our new #9A-4½ J & L Saddle Type Turret Lathe performs a normally twenty minute operation in three minutes. Steel forgings (twenty inches in diameter) have one-half inch of stock removed from *both* O.D. and I.D. with a .015 feed and a spindle speed of 489 RPM. There is no sign of vibration under the strain nor does the machine falter.

"Rigidity" built into Jones & Lamson's equipment to permit a heavy cut at high speed is my answer to increased production.

— Mechanical Engineer —

Tough job made easy

The operation was rough turning cylinder barrels on a Fay automatic lathe.

This machine had 2 sets of tool blocks with 2" square tool bits, one set feeding into the cut from the front and one set feeding into the cut from the rear. The material was Chrome Molybdenum steel, hot forged. We removed as much as 100 pounds of metal from this forging in less than five minutes. The cuts were 2" wide and about ¼" thick. It was a high production job, as there are twelve of these cylinder barrels to a motor. When the chips cooled, due to the heat generated in removal, they were a deep blue color. This was as tough a job as I have witnessed. This machine demonstrated the design and quality of Jones & Lamson lathes.

— Machine Buyer —

(names of these customers available on request)

Adv.

. . . to Jones & Lamson Machine Company

512 CLINTON ST., SPRINGFIELD, VT.



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is a tough air-hardening tool and die steel that saves money and time by virtually eliminating the fitting and adjusting of dies after hardening. Its ability to resist distortion and size change is the most dependable in the industry. VEGA is the only steel that combines the machining properties of an oil-hardening grade with the safety in hardening normally found in air-hardening steels.



Prove it to yourself. Call your local Carpenter SERVICE-CENTER today for immediate delivery.

the *Carpenter* Steel Company, Reading, Pa.

MARVEL NO. 8 BAND SAW makes a tough job EASY...

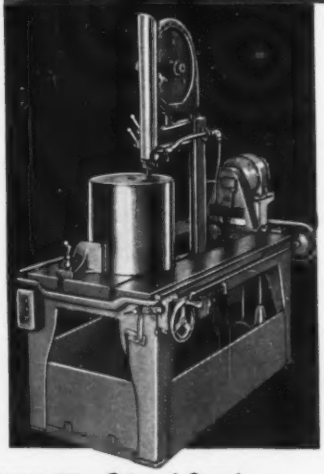


FLOOR TO FLOOR IN 5 HOURS... no special jigs, fixtures or set-up required

The versatility, simplicity of operation and unmatched efficiency of a MARVEL No. 8 Universal Metal Cutting Band Saw makes it the best all-around saw you can buy.

Take the job illustrated, as an example. Three equally spaced re-entrant cuts were required to segment a large, heavy die forging. The work was merely placed on the table between the vise jaws with the first lay-out line positioned to bisect the blade. Feed pressure was set on the direct-reading scale and the cut started. On a MARVEL No. 8, the work is always stationary and the blade is fed into the work; the cutting edge of the blade is always square with the table throughout its full feed traverse, which eliminates the need for special fixtures. The pre-set Automatic Overload-Relief Power Feed kept the blade moving into the work only as fast as it could freely remove the metal; as the vertical length of the cut decreased, the blade was automatically fed faster, thus increasing cutting speed. Upon completion of a cut, the blade was rapidly returned to its starting position by a rapid traverse handwheel located at the operator's position. Succeeding cuts were made in the same manner, with the same ease and speed.

Jobs like this aren't done every day, but they serve to emphasize the versatility of the MARVEL No. 8, a truly universal metal cutting saw. If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.



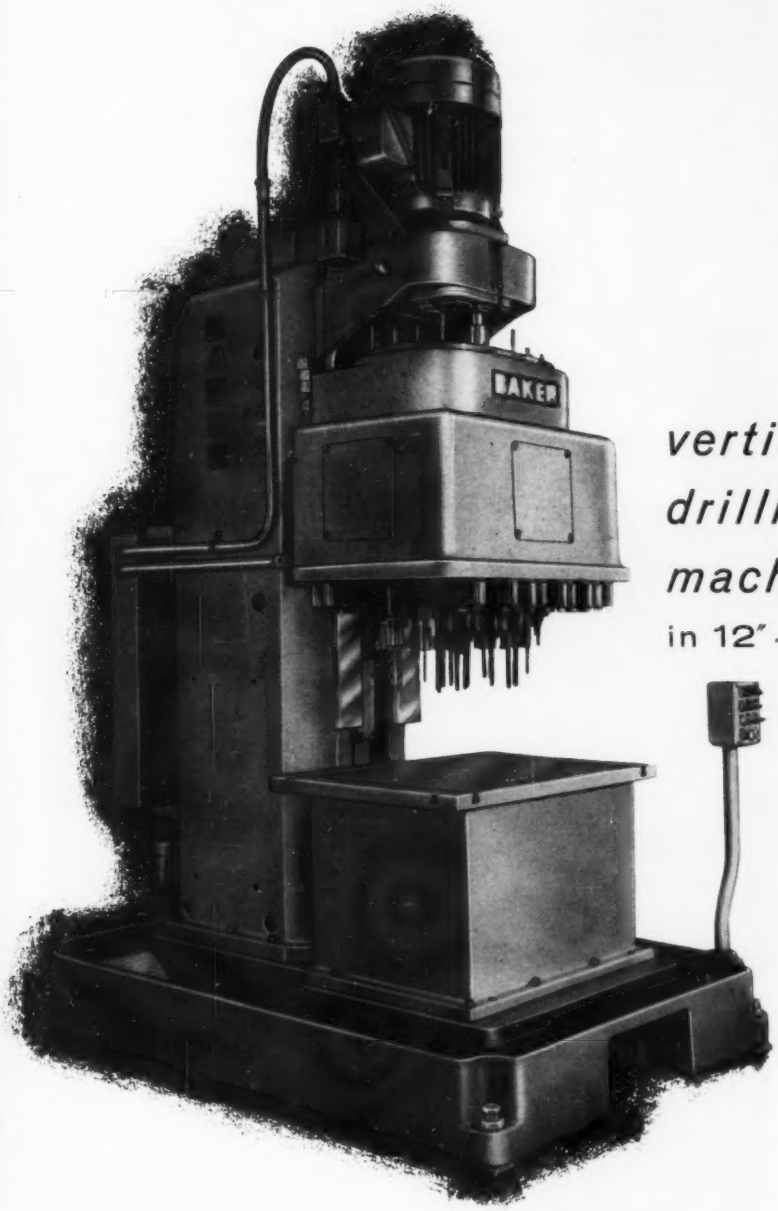
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MARVEL Metal Cutting SAWS
Better Machines-Better Blades

S-1302

new!

BAKER™



vertical hydraulic drilling and tapping machines

in 12″ - 18″ - 24″ way widths

BAKER BROTHERS, INC. TOLEDO 10, OHIO

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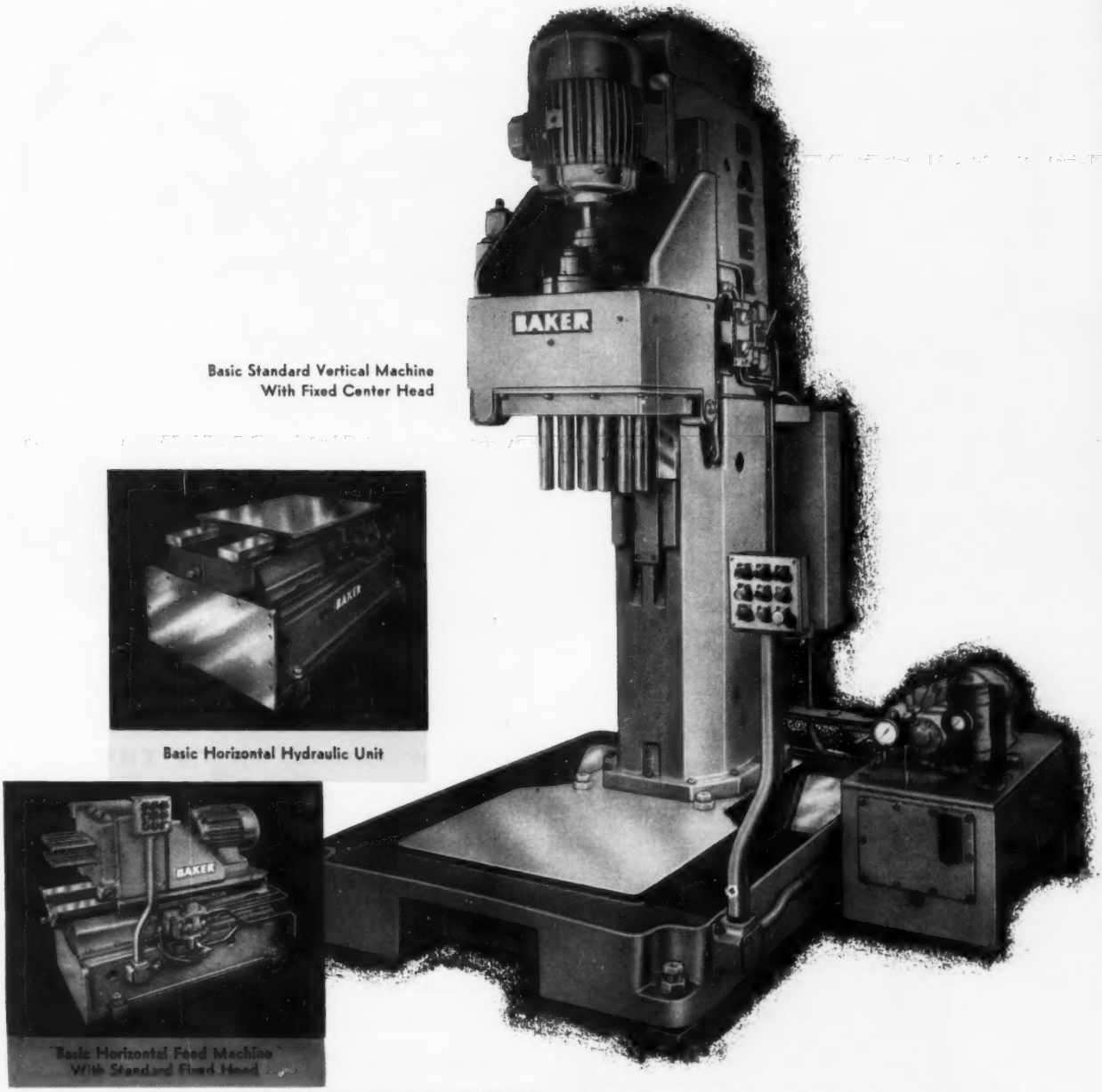
NEW Baker Vertical and Horizontal Drilling and Tapping Machines are the *most versatile* machines available today. Fixed and adjustable heads, along with other standard components, can be added to these standard basic machines. Complete flexibility permits accomplishing any production drilling or tapping operation. Designed for years of precision work with minimum maintenance, reduced stocking and low-cost retooling. New catalog just off the press . . . send for it and the name of BAKER representative nearest you.



Basic Standard Vertical Machine

BAKER BROTHERS, INC. TOLEDO 10, OHIO

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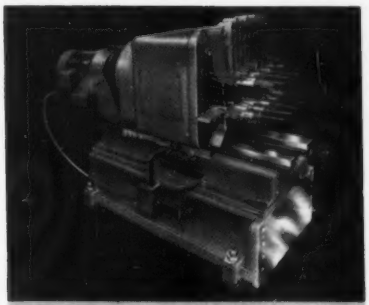


Basic Standard Vertical Machine
With Fixed Center Head

Basic Horizontal Hydraulic Unit

Basic Horizontal Feed Machine
With Standard Fixed Head

NEW HORIZONTAL HYDRAULIC FEED UNITS, TOO!



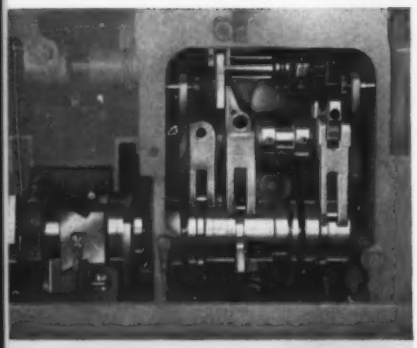
Basic Horizontal Feed Machine
With Standard Adjustable Head

BAKER BROS., INC.
TOLEDO 10, OHIO

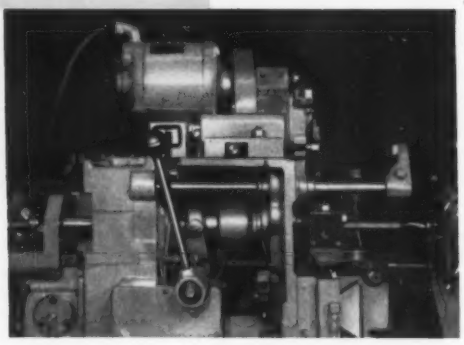
BAKER

AUTOMATIC BAR MACHINE





DESIGNED FOR FAST SET-UP AND MAXIMUM CONTINUOUS PRODUCTION—Slide and attachment cams (above) are quickly mounted on sliding shaft, lock securely in position. Below: Slides have micrometer adjustment, are readily accessible to simplify machine operation.

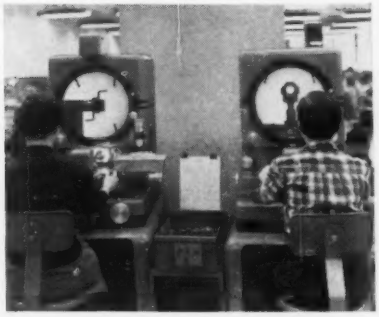


A NEW ADDITION TO THE BAKER LINE

The Baker Automatic Bar Machine overcomes traditional limitations in spindle speed and parts length. This standard ¾″-capacity machine permits high-speed machining of parts up to 18½″ long without "trick" tooling. A dependable, instant-reversing transmission allows different spindle speeds for six different cutting operations, with speeds in any cycle infinitely selectable up to 7200 RPM. Revolutionary unit construction ends obsolescence, slashes maintenance cost and downtime. The Baker Automatic Bar Machine is available *now* to expand your production.

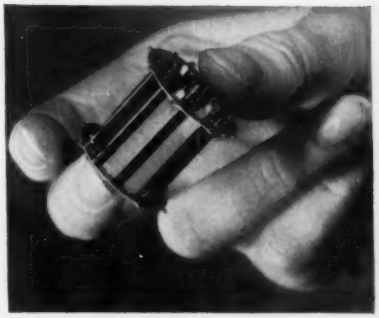
BAKER BROTHERS, INC.
TOLEDO 10, OHIO

See how optical gaging solves 4 basic inspection problems faster... at less cost



(1) RECEIVING: With optical gaging you get *immediate* checks on tolerance for incoming precision parts. One glance tells whether parts are to your specification. For example:

Inspectors at the *Allen-Bradley Company*, makers of electrical equipment, use Kodak Contour Projectors for fast, accurate inspection of incoming precision parts. They check *more than 400 different items*, most with multiple dimensions, and sample size of 35 or more pieces. Tolerances are held to .001". Since optical gaging permits checking several dimensions at once, Allen-Bradley has drastically cut inspection time. Parts are quickly cleared for production; quality control is better.



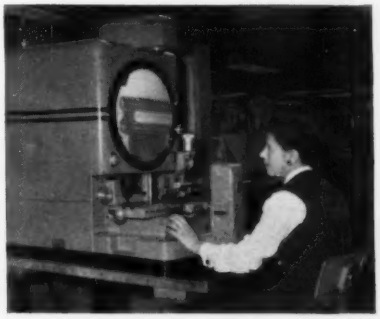
(2) ASSEMBLY: Mass producing your product may require fast yet accurate inspection of precision component assemblies. Here's how one manufacturer solved the problem:

Magnetron Beam Switching Tube, produced by *Electronic Tube Division, Burroughs Corporation*, has 21 elements which fit into mica holding-wafers at top and bottom. The elements must be lined up to within .002" of specifications. The problem was to do this complex inspection job *fast enough to keep up with assembly speed* in mass production. With a Kodak Contour Projector the inspector can easily match top assembly speeds while maintaining the required specifications.



(3) FINAL INSPECTION: You can inspect a great variety of finished parts quickly with the Kodak Contour Projector—and cut costs, too.

In one instance, a great variety of component parts for various manufacturers posed a serious inspection problem for *Auburn Plastics, Inc.*, a custom molder. The firm formerly used mechanical gages in large numbers to make necessary quality control checks. A Kodak Contour Projector eliminated the expense of buying mechanical gages (savings amounted to $5,000 in one instance). Now operators can inspect at a glance finished components—gage angles, radii, holes, and other dimensions—with an accuracy that meets close tolerances.



(4) PRODUCTION: Optical gaging gives you accurate, fast inspection of tools and dies during use in production.

For example, at *Stromberg-Carlson*, a Division of General Dynamics Corp., die life presented a complex gaging problem. Checking by conventional gaging methods was cumbersome, time-consuming, and inaccurate. Optical gaging of piece parts with a Kodak Contour Projector now provides a quick, accurate check of die wear during production. A typical example concerns a die which stamps out relay lever arms. The 35 dimensions of the lever arm are optically checked in 1/3 the time of other gaging methods.

Optical gaging with the Kodak Contour Projector saves time because you can check many dimensions at a glance. Saves you money, too, because one projector does a wide variety of gaging jobs. Changing from one type of part to another is a simple matter of changing your chart-gages on the screen and your fixtures.

Whatever your inspection or measuring problem may be, there's a Kodak Contour Projector to do the job—from the compact bench-type Model 8 to the big Model 30 with its 30-inch screen and large part capacity.

For additional details, send for the new illustrated booklet "Kodak Contour Projectors." Write to:



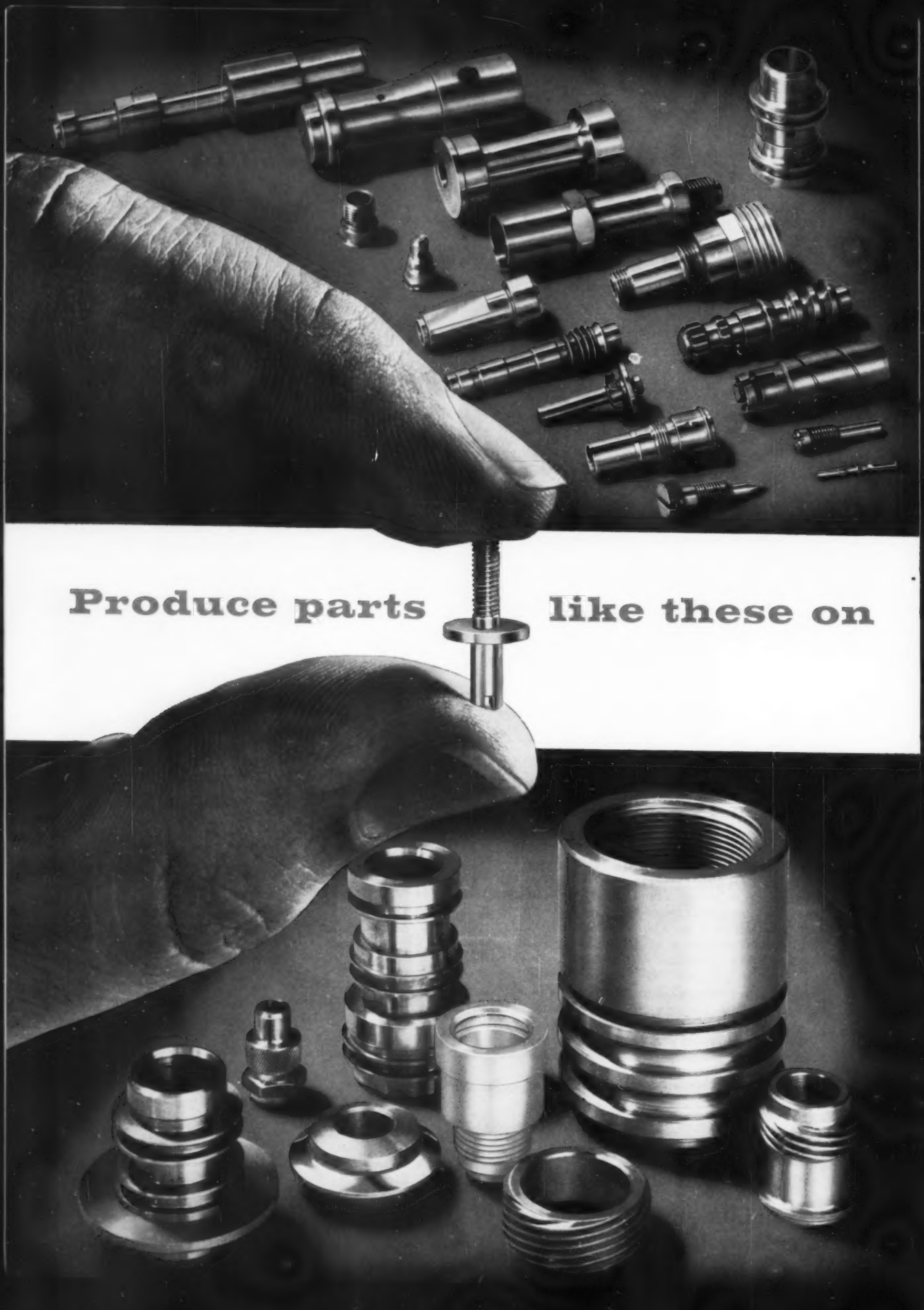
Apparatus and Optical Division

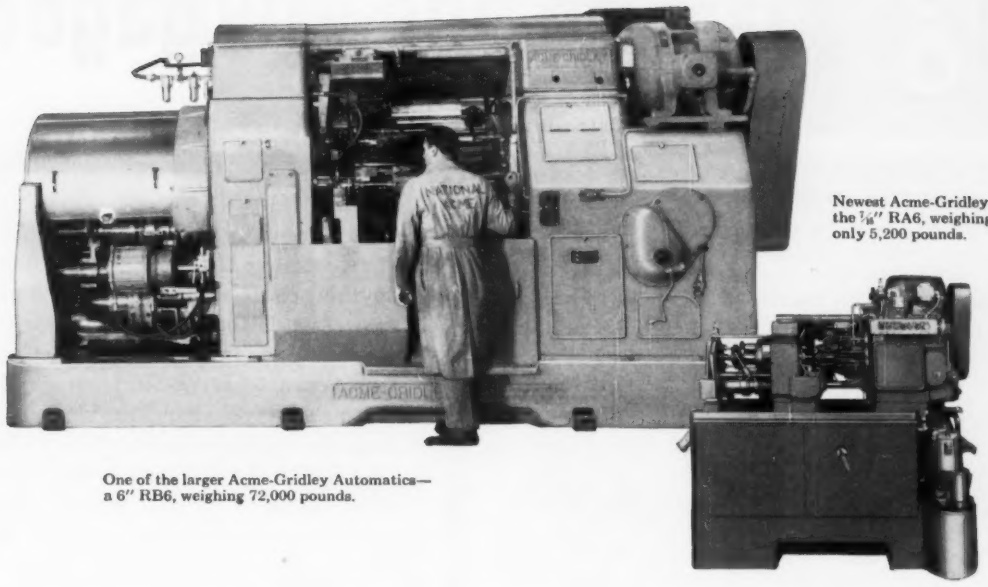
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

For more data on any products advertised this issue use card, page 193


Produce parts like these on



Newest Acme-Gridley—the 1⅛" RA6, weighing only 5,200 pounds.

One of the larger Acme-Gridley Automatics—a 6" RB6, weighing 72,000 pounds.

ACME-GRIDLEY automatics . . .

FORGET SECONDARY OPERATIONS!

Most parts machined on Acme-Gridleys are *completed* on Acme-Gridleys. Using these Automatics, you eliminate costly rehandling and, in many instances, avoid a sizeable second-machine investment.

The advantage applies to parts weighing fractions of ounces or hundreds of pounds. And the wide-open tooling zone of every Acme-Gridley lends itself to a broad range of installations limited only by the tool engineer's ingenuity. It means that, for sheer capacity range, no line of automatic production equipment in the world equals Acme-Gridley.

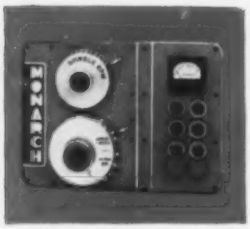
If you produce parts like the ones illustrated, then Acme-Gridley Automatics must be in your present plans. Our representative can give you expert assistance without obligation.

National Acme

THE NATIONAL ACME COMPANY, 179 E. 131st ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

the Monarch gage for

THE HEADSTOCK THAT THINKS... AND REMEMBERS



1. 36 speeds—range 14 to 1750 R.P.M.—ratio 1 to 125. Standard range low enough, high enough and with plenty of speeds in between to provide reasonably constant surface cutting speed on most work.

2. Optional extra-high speed range of 25 to 2500 R.P.M. available for free cutting metals such as aluminum and for ceramic tooling requirements.

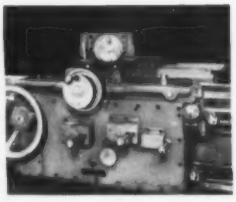
3. Operator works in terms of surface cutting speed. Machine automatically figures correct R.P.M. and sets up shift. Operator sets two large dials—one for work diameter, the other for desired surface speed.

4. Using the two-dial preselector, up to six or more different speed changes may be preset while machine is under cut. This saves speed change time when turning successive diameters having considerable variation or when finish turning immediately follows rough turning. The second dial always indicates spindle speed in engagement.

5. Pull of knob gives free spindle in a jiffy. And there is a generous $2\frac{1}{16}$" hole through the spindle.

6. Hydraulic brake and clutch are self-adjusting for wear. Being under automatic machine control regardless of load, operator need not supply power for engagement.

THE CONTROL CENTER OPERATORS LIKE



1. Series 62 is controlled by a three-position lever at the apron. A duplicate lever close to the headstock is provided for setup purposes. With it, work rotation may be started or stopped, jogging or speed change may be accomplished. In the SPEED CHANGE position the next speed is engaged automatically when preselection is used.

2. Shifting (an operation performed many times each day) is at finger-touch ease and speed. Hydraulic power does the work of clutching, braking, shifting and jogging.

3. Four-way power rapid traverse is in-built. Both carriage and cross slide traverse may be engaged simultaneously. This saves as much as 50% in tool adjust time.

4. Positive cam controlled feed frictions. Application is such that machine never loses its chip under heavy cuts.

5. Apron or headstock controlled leadscrew reverse, the former a must when much thread chasing is done.



ELECTRICALS WHERE THEY SHOULD BE

1. External main drive motor mounting and external electrical control mounting (either NEMA or JIC) for quick accessibility.

2. Motor mounted on hydraulic system sump from which position it also supplies power for hydraulic pump.

How do your lathes measure up? You get what you pay for in the purchase of a lathe, as with anything else. Greater production, therefore lowered costs, is the major reason for acquiring a new machine. That's what you get in the Monarch Series 62 Dyna-Shift—the only lathe of its general type which can be kept under full load during the entire machining cycle. Major contributing factors design-wise are more machine output per unit of power input, less operator effort, reduced maintenance and ease of supervision. See for yourself why the Series 62 meets all these requirements as does no other lathe on the market.

Users have found that these features and advantages have translated themselves into production increases of 25% or more and tool life improvement up to as much as 50%. And that's the pay-off. When you are ready to invest in a new lathe, buy the best. It's the cheapest in the long run.

THE MONARCH MACHINE TOOL COMPANY

SIDNEY, OHIO

COMPLETE AUTOMATIC LUBRICATION

1. Headstock, end gearing and gear box served by single system of the filtered, combination mist-splash type.

2. Apron lubrication system of the circuited, metered and filtered type also provides oil to carriage guide ways and cross slide bearings.

3. Tailstock has its own lubrication system.

INTERLOCKS FOR SAFETY

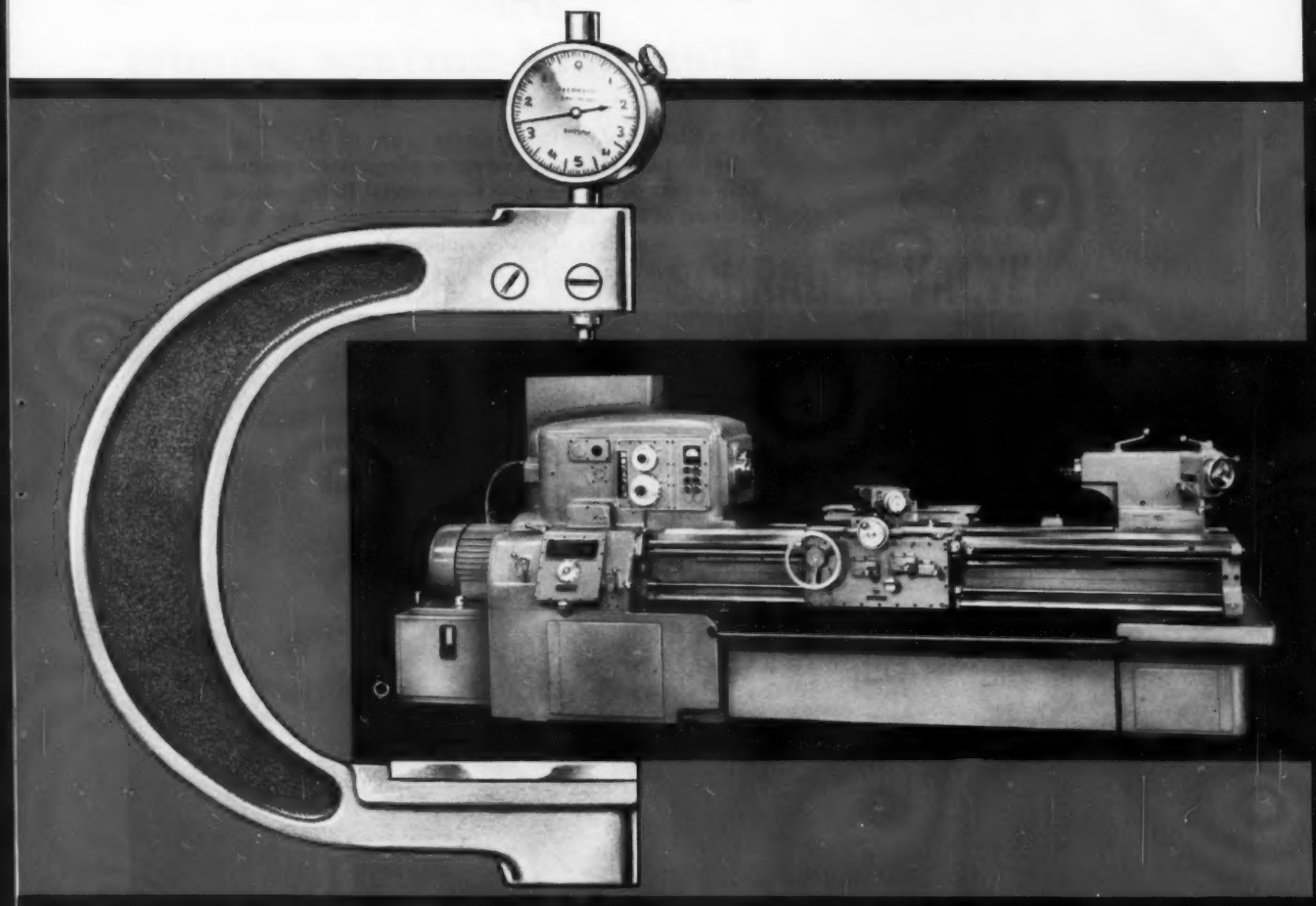
1. When machine is started, the brake engages automatically, preventing spindle rotation regardless of main control lever position.

2. No speed shift can be made with spindle rotating. More than anything else this preserves the original accuracy of headstock gearing.

3. Leadscrew and feed rod cannot be engaged simultaneously; neither can feed and power rapid traverse.

4. Leadscrew reverse cannot be engaged with spindle rotating above 340 R.P.M.

series 62 lathe–
productivity and precision



PROTECTED GEAR BOX AND END GEARING

1. Gear box and end gearing totally enclosed. Lubrication is kept in, dirt kept out, original accuracy maintained.

THE BED...A FIRM FOUNDATION



1. All four bed ways flame hardened and precision ground to keep them factory-fresh for years to come.
2. Generous size chip pans are designed for easy chip removal at front or rear.
3. Longer machines equipped with traveling rod supports which are automatically picked up and dropped off by apron.

TAILSTOCK THAT MEANS BUSINESS



1. Either single speed or two speed range type available with dead or anti-friction center spindle. Sufficient mass and rigidity to support the heaviest of cuts.
2. Movement along bed manually or by power. This combination satisfies all turning conditions.

SUPERVISORY PROBLEMS SIMPLIFIED

1. At a quick glance, supervisor may check (a) work diameter setting, (b) SFPM setting and (c) H.P. consumption. This makes it possible easily and quickly for him to assure full productiveness of machine and operator at all times.

ADDED EQUIPMENT FOR ADDED PRODUCTION

1. Additional equipment in vast variety is available for the Series 62 line. Consider, by all means, the advantages of the "Air-Gage Tracer," a means by which thousands of users have reduced costs substantially.
2. Ask for descriptive booklet No. 1506 which not only describes the basic machine but the commonly used items of additional equipment. It includes full specifications.

Monarch
TURNING MACHINES



This valve gets a leak-proof seal from a Blanchard Surface Grinder

"The Blanchard Surface Grinder is one of the most important improvements in our modernization program." This report comes from the Commercial Refrigeration Division of Bendix-Westinghouse Automotive Air Brake Company—makers of power and condensing units for refrigeration equipment.



The Blanchard No. 18 Surface Grinder puts a surface of 5 micro inches or better on Bendix-Westinghouse valves at the rate of 75 pieces an hour.

A Blanchard Model 18 Surface Grinder is used to finish grind valve plates used in Bendix-Westinghouse electric refrigeration compressors. They say: "This operation is very important, because—with a surface finish of five micro inches or better—we get a perfect seal on our gaskets and valves, eliminating the possibility of leakage."

Is there room for improvement in *your* surface grinding? For best results...

Write today for your free copy of "Work done on the Blanchard," fifth edition, and "The Art of Blanchard Surface Grinding," fourth edition.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

TYPICAL SCHRADER SIMPLIFIED VALVE DESIGN

. . another reason why your air system installations will perform best.

A—Mounting holes always conveniently located.

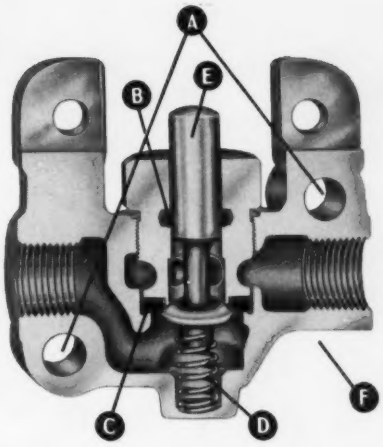
B—"O" rings used for surest airtight seal.

C—Oil-resistant synthetic rubber used in washers for positive leakproof seat.

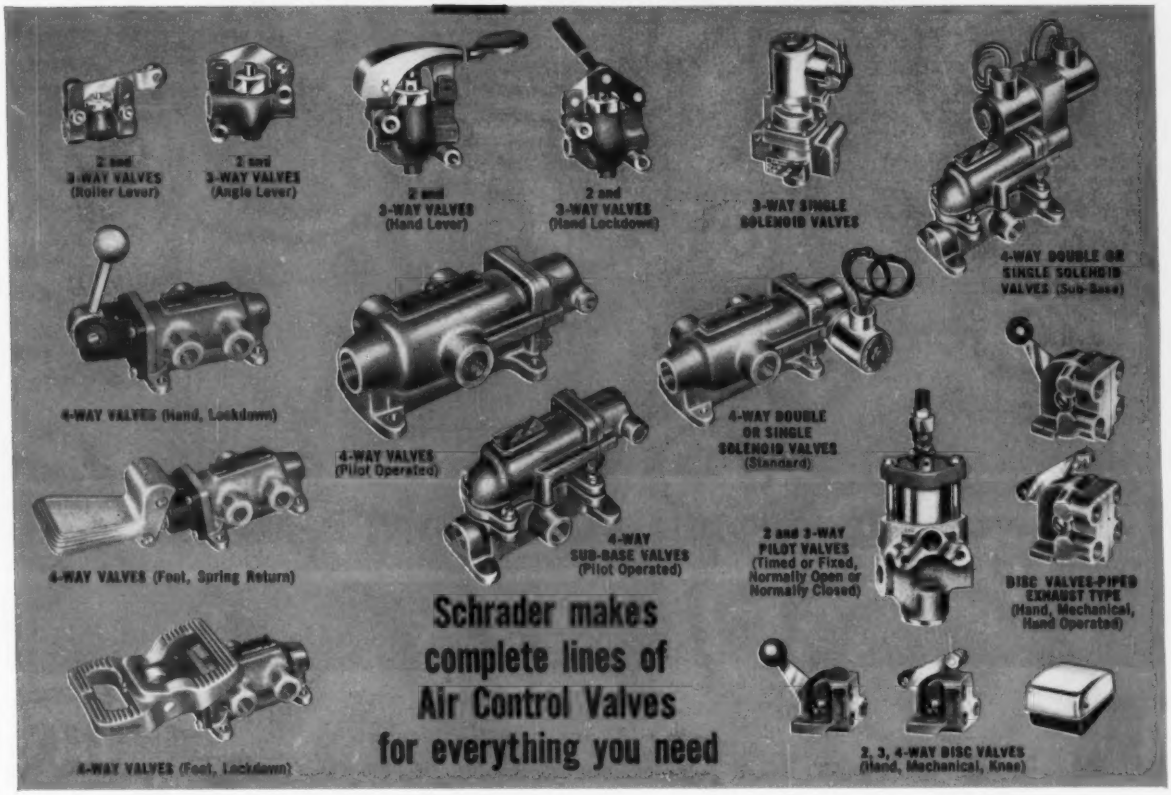
D—Stainless steel springs: rust resistance, longest service life.

E—Sturdy plated plungers, quick acting, smooth-operating.

F—All parts designed for greatest air flow, longest life and simplicity of replacement and interchangeability.



INSIDE EVERY SCHRADER VALVE YOU CAN SEE SCHRADER QUALITY



Plus hundreds of Air Cylinders and accessories for every need

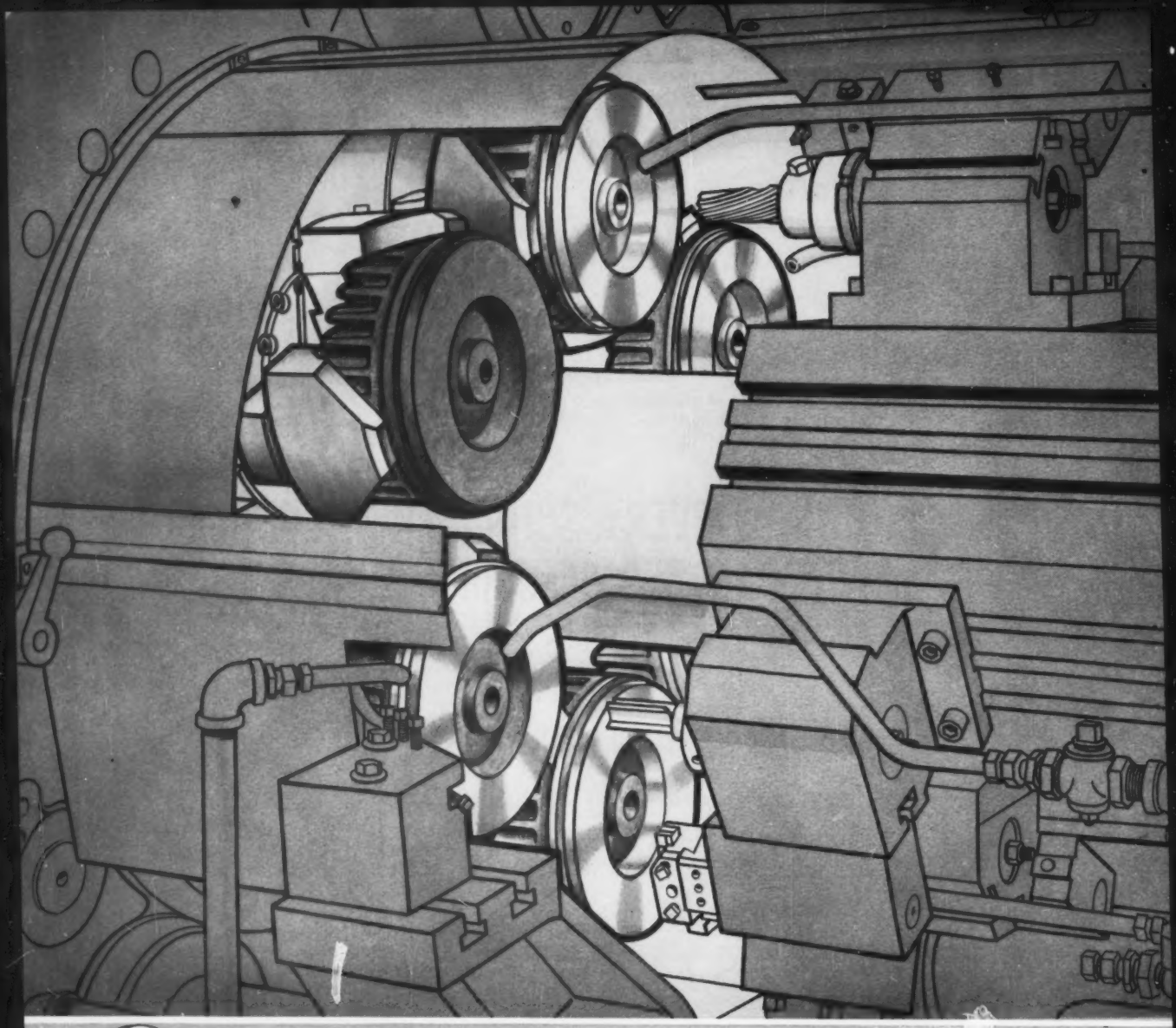


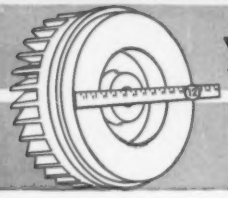
Send for Schrader Catalog on full line of air control products.

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454 Vanderbilt Avenue, Brooklyn 38, N. Y

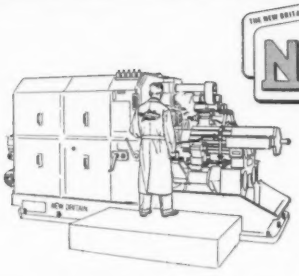
QUALITY AIR CONTROL PRODUCTS



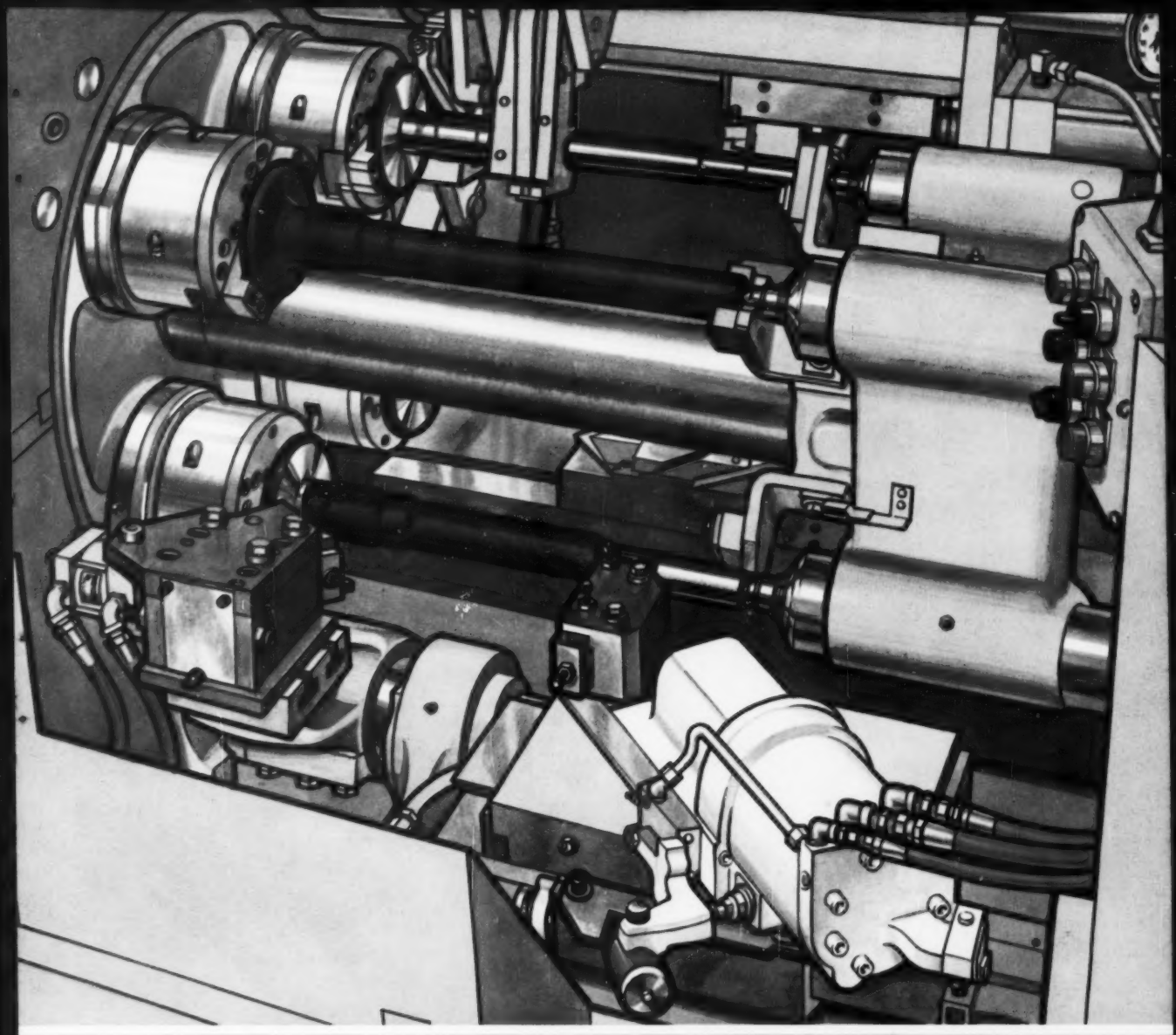


yes! you can put it on a New Britain

Now the larger pieces which formerly necessitated slower methods because of their size can be turned out at lower cost. You can, for the first time, apply New Britain standards of productivity to larger work with the *new* New Britain four-, six- and eight-spindle chuckers . . . new, larger chucking capacities (up to 15 inches), with spindle speeds, power and ruggedness to match, and all the exclusive New Britain advantages. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



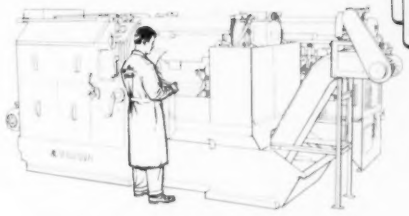
Automatic Chucking Machine



copy more than three times faster on

New Britain 4-spindle copying lathe

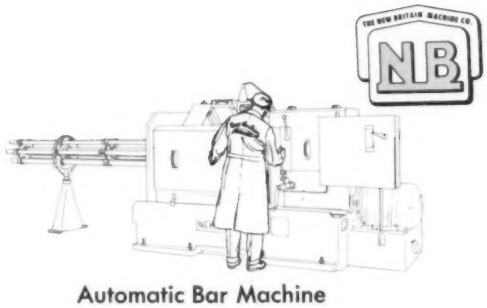
For the first time... multiple spindle copy turning. Loading station and three work stations. Work chucked between centers which index together. Template-controlled hydraulic slides perform copy turning; cross slides and/or forming arms perform a wide variety of additional operations. Two-speed spindles, automatic loading and unloading, and automatic chip conveyor optional. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Model 412/25 Copying Lathe

New Britain's new bar machines permit unlimited tooling combinations

An independent cross slide for every spindle means more operations with simpler tools and attachments. Three size ranges: Model 52 with 1¼" capacity and model 62 with 1⅝" or 2¼". Pick-off change gears permit a wide range of spindle speeds, as low as 117 r.p.m. (62 series) and as high as 4249 r.p.m. (52 series) for maximum production efficiency. Readily accessible tooling area and cross slide cams permit faster changeover. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Bar Machine

This is an ideal time to have new-machine accuracy rebuilt into your New Britains by New Britain

Ruggedness and dependability have been built into every New Britain machine ever sold. For a fraction of the replacement cost you can have your older New Britains restored to new-machine accuracy. Rebuilding eliminates the high cost of frequent shutdowns and returns the machine to full efficiency, performing every operation it was designed to perform.

At New Britain your machines will be rebuilt with the same production facilities that originally built them. Established reconditioning procedures, based on long experience, will put your rebuilt machines back on the line in the shortest possible time. Wherever possible, your machine will have the benefits of the newest improvements in parts and assemblies.

With New Britain your rebuilt machines carry a new-machine warranty.

Your New Britain field engineer or sales representative will help you determine the rebuilding program best suited to your needs. Call him, or write or phone the factory direct, c/o Service Sales Manager, The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



THE SOLUTION TO YOUR

"JOINT TROUBLE"

IS U. S. DRILL HEADS!

This is no "medicine man" talk! U. S. Universal Joint Heads have greater reserve stamina than you'll ever need! Heavy-duty joints are specially heat treated for greater capacity than rated . . . drivers and spindles have more than ample bearing . . . shaved gears insure smooth, quiet, full-power performance.

Get profit-making universal joint adjustability with U S. Drill Heads. Less downtime, quicker changeover, positive hole positioning. And, for long production runs, Slip Spindle Plates provide the advantages of fixed center heads.

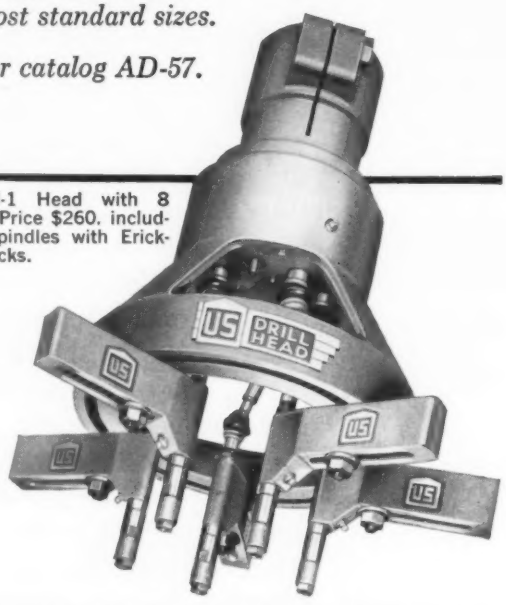
Immediate delivery on most standard sizes.

Write for catalog AD-57.

Only U. S. Drill Head provides a FULL RANGE of **standard** Universal Joint Adjustable Heads

Style Head	No. of Drivers	Drilling Capacity	Drilling Area (Dia.)
U-1	8	¼"	6"
U-1L	8	¼"	8"
U-1½	6	½" or ¾"	6"
U-2	10 or 12	½" ¾"	10" 9¾"
U-3	10 or 12	15/32" to ⅞"	12"
U-4	12	15/32" to 1-1/16"	15"

Style U-1 Head with 8 drivers. Price $260. including 2 spindles with Erickson chucks.



Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO



These are exact words from the production officials of The Cleveland Worm and Gear Company, of Cleveland, Ohio, which company produces the universally known and widely used Cleveland Worm Gear Speed Reducers.

The machine to which they refer is their new "AMERICAN" DeLuxe Model Hydraulic Duplicating Lathe. This lathe, as the illustration shows, is used primarily for machining worm forgings from a round template.

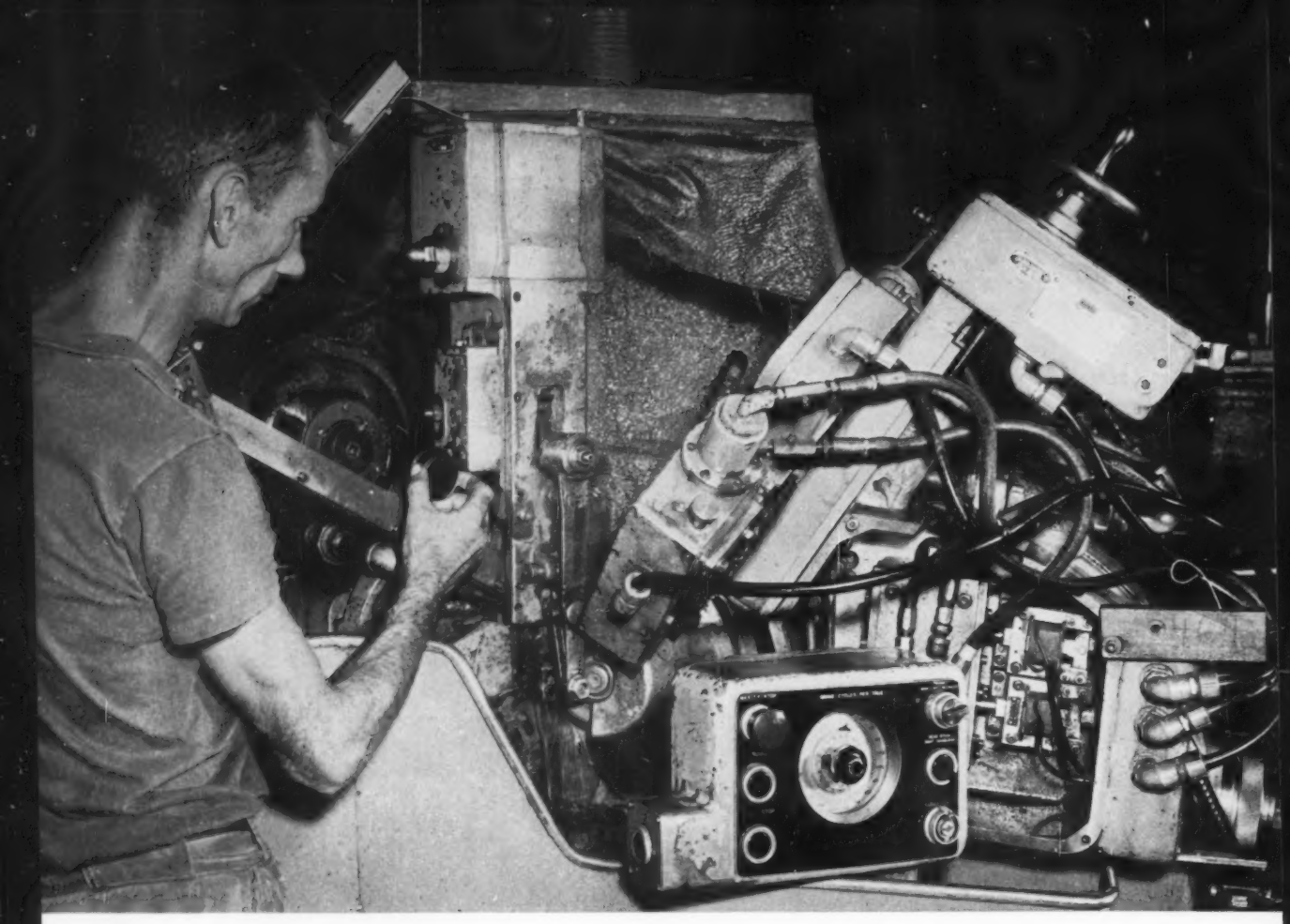
Accurate duplication of parts, high speeds, heavy cuts, plenty of power, quick acting air operated tailstock and ease of operation are the major characteristics contributing to the amazing productivity of this machine.

More production per man hour is the answer and only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour. Judging from reports, The Cleveland Worm and Gear Company has found this to be true.

Bulletin No. 135
gives a complete description and shows many examples. It's yours for the asking.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



bearing life boosted from

THREE WEEKS TO FOUR YEARS

with Texaco Cleartex Oil

Tyson Bearing Corp., Division of SKF Industries, Massillon, Ohio, extended the life of micro-centric grinder bronze sleeve bearings from 3 weeks to 4 years (and they're still going strong) using *one* oil—Texaco Cleartex B—for both grinding *and* machine lubrication.

Before Cleartex was used, machine bearings would fail in about 3 weeks, because the lubricant became contaminated by grinding oil. With Cleartex this problem simply doesn't exist. A premium quality lubricant, Cleartex is *also* a fine grinding oil. In fact, Tyson now gets as many as 20 pieces per wheel dressing, each with a better finish, compared to the 10 or 12 that were previously obtained.

You can do any machining work better, faster and at lower cost with Texaco—a complete line of cutting, grinding and soluble oils. A Texaco Lubrication Engineer will gladly help you select the right ones for your job. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York 17, N. Y.



LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

- Inflation Count-Down
- Tax Overhaul Move
- Where's Defense Business?
- 5000 Surplus Tools
- Broken Packages



Keeping up with Washington

Loring F. Overman

With the Eighty-fifth Congress a thing of the past, barring the unlikely possibility of a special session, official Washington settled down to its between-session problems.

Inflation Count-Down

Particularly troublesome were official Washington's efforts to cope with symptoms of a new period of inflation, at a time when some parts of the economy still suffer from effects of the recession.

Administration has indicated that it hopes to make the change-over by inducing labor to forego wage increases that outstrip productivity, and by encouraging management to halt further price increases until the economic situation clarifies.

Some Washington observers hold that the only solution lies in federal controls over wages, prices, rents, profits, etc. The President has indicated he "is not ready" to slow down inflation by using a brake marked "Emergencies Only."

Despite the President's preference for a voluntary labor-management solution, the Eighty-fifth Congress was not without proponents of stand-by legislation which would have authorized the President to impose "emergency-brake" controls under specified conditions.

Tax Overhaul Move

Winter months may see little evidence of activity on the tax overhaul front. Similarly, there will be minimum publicity for the program which seeks to win more favorable depreciation formulas for machine tools and other capital equipment.

At the Business and Defense Services Administration, where Niels A. Olsen heads the Metalworking Equipment Division, spokesmen indicate that the closing of the Eighty-fifth Congress offers additional time in which to rally the machinery industry in support of a more realistic method of evaluating, depreciating, and retiring machine tools.

Where's Defense Business?

The Federal Government continues to be industry's biggest customer, its purchases increasing from $64,000,000,000 in 1955 to $74,000,000,000 in 1958, and to possibly $80,000,000,000 in fiscal year 1959. Largest segment of this, approximately $40,000,000,000 in 1959, is for defense—reason enough for the machine tool industry to learn where contracts go.

The Department of Defense has indicated that fifteen states each received more than a billion dollars in defense contracts from January 1955 to March 1958. California led the field at $11,147,513,000, according to a DOD summary of "Military Prime Contracts, by State." New York State was the runner-up, with contracts totalling $6,705,862,000 during the same period. Ohio, Texas, and Connecticut received contracts valued, respectively, at $3,459,081,000, $3,442,623,000, and $3,232,530,000.

Other areas over the billion dollar mark include: Washington, $2,196,250,000; Pennsylvania, $2,232,019,000; New Jersey, $2,919,743,000; Illinois, $2,187,773,000; Missouri, $1,365,387,000; Michigan, $1,049,663,000; and Massachusetts, $1,736,735,000.

5000 Surplus Tools

Selection of 5000 surplus machine tools per year for assignment to the National Industrial Equipment Reserve is anticipated in a General Services Administration request for an additional $2,500,000 to cover storage, handling, and other details of the program.

In justifying its request for additional funds, GSA explained: "Each of the military departments maintains a reserve of equipment needed for the current mobilization requirements of its direct procurement producers. Items selected for the NIER (National Industrial Equipment Reserve), however, are intended primarily for the expansion of those industries whose support of defense production can be identified, but which do not hold direct military contracts or specific designations as mobilization suppliers (manufacturers of gears, machine tools, etc.).

"The Department of Defense and the Office of Defense Mobilization have advised General Services Administration that excess declarations on production equipment may run as high as 12,000 per year for the next three years, and that selections therefrom for the National Industrial Equipment Reserve are estimated at 5000 items per year.

"The reserve of government-owned machine tools and industrial manufacturing equipment authorized by the National Industrial Reserve Act of 1948 consists of items . . . from lists of such property declared excess to the needs of the three military departments and other executive agencies."

Broken Packages

Revised instructions specifying how machine tools are to be made available from the Production Equipment Redistribution Inventory, for use in current production, have been issued by the Defense Department.

The changes are made in pages 9 and 10 of DOD Directive 4215.9, copies of which are available through the Production Equipment Redistribution Group (PERG), Department of Defense, Washington 25, D. C.

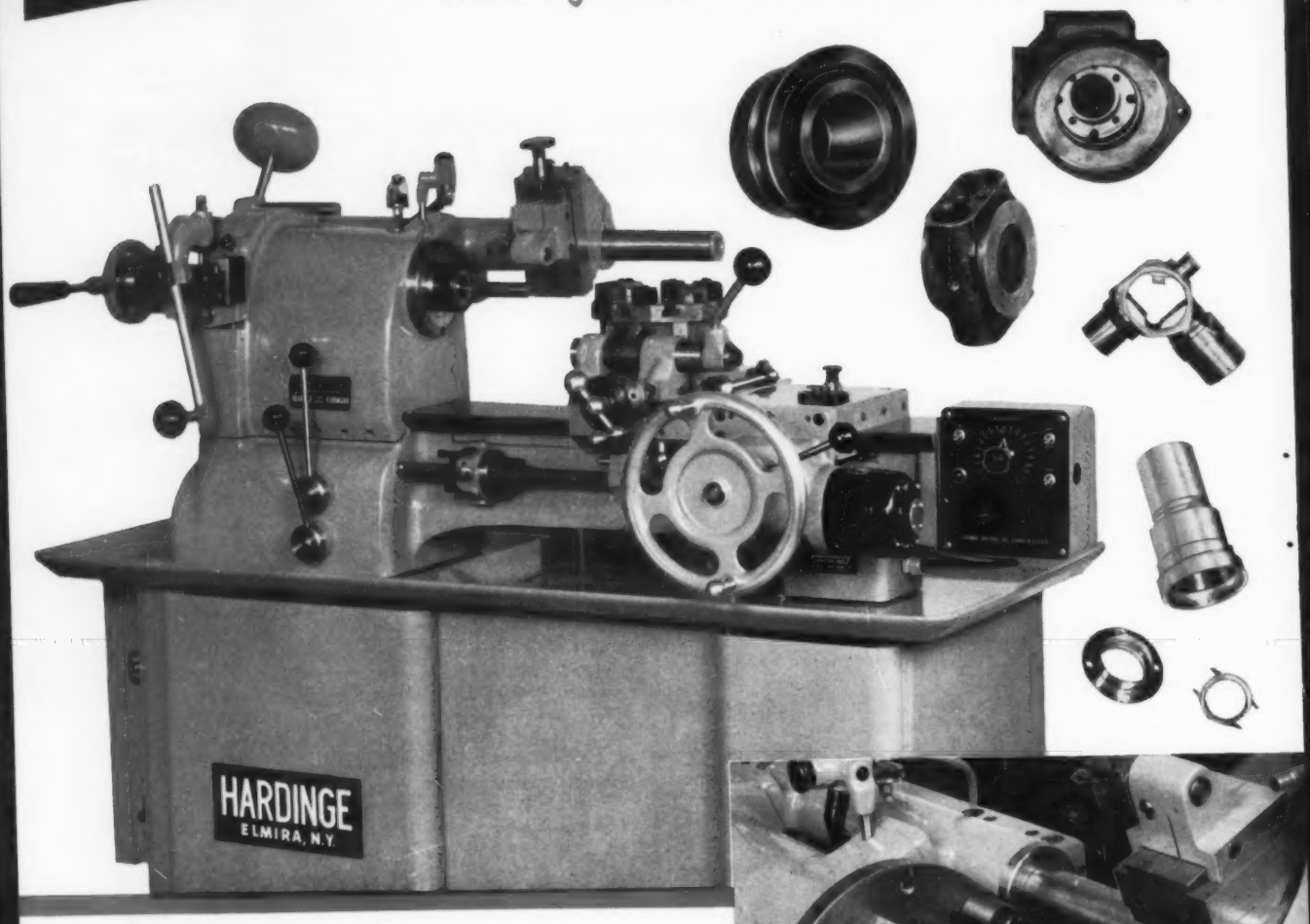
The revised version states that listed equipment would be allocated for use "on military contract or on millitary establishments . . . when equipment is requested . . . for current production use, for rehabilitation and modernization of government-owned facilities . . . or for assignment to specific package plants or stand-by lines to fill the gaps in substantially complete packages and lines."

HARDINGE
ELMIRA, N.Y.

PRECISION CHUCKING MACHINE

Users say:

"We now get Production with Tool Room Accuracy"





Users enthusiastically tell us how they can easily maintain close tolerances, get better parts finish, and at the same time substantially cut costs . . . when they put Hardinge High Speed Precision Chucking Machines to work.

These results are possible because parts are finished in one setting with simplified tooling. All parts shown were produced with standard tool bits.

1 1/16" Collet Capacity— 6" Chucking Capacity— Write today for Bulletin HC-HCT which presents the whole story.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Machinery
OCTOBER 1958

Leave It to the Specialists

MANUFACTURERS of components and units that are incorporated in machinery built by other companies are sometimes plagued with problems that arise because of faulty application and inadequate maintenance of such units when the machine user installs the equipment. Automatic gaging devices, special drives, and electronic controls come under this category.

When such devices fail to function satisfactorily, the blame is invariably placed on the producer of the units, even though that concern did not install the equipment. The producer, therefore, should not be held responsible for any malfunction.

Similar complaints arise when the user of such special equipment makes repair parts himself or applies repair parts obtained from sources other than the original manufacturer of the device. Obviously, that manufacturer should not be held accountable. The same condition sometimes exists when a user rebuilds a complete machine, involving the disassembly and reassembly of individual parts and complete units.

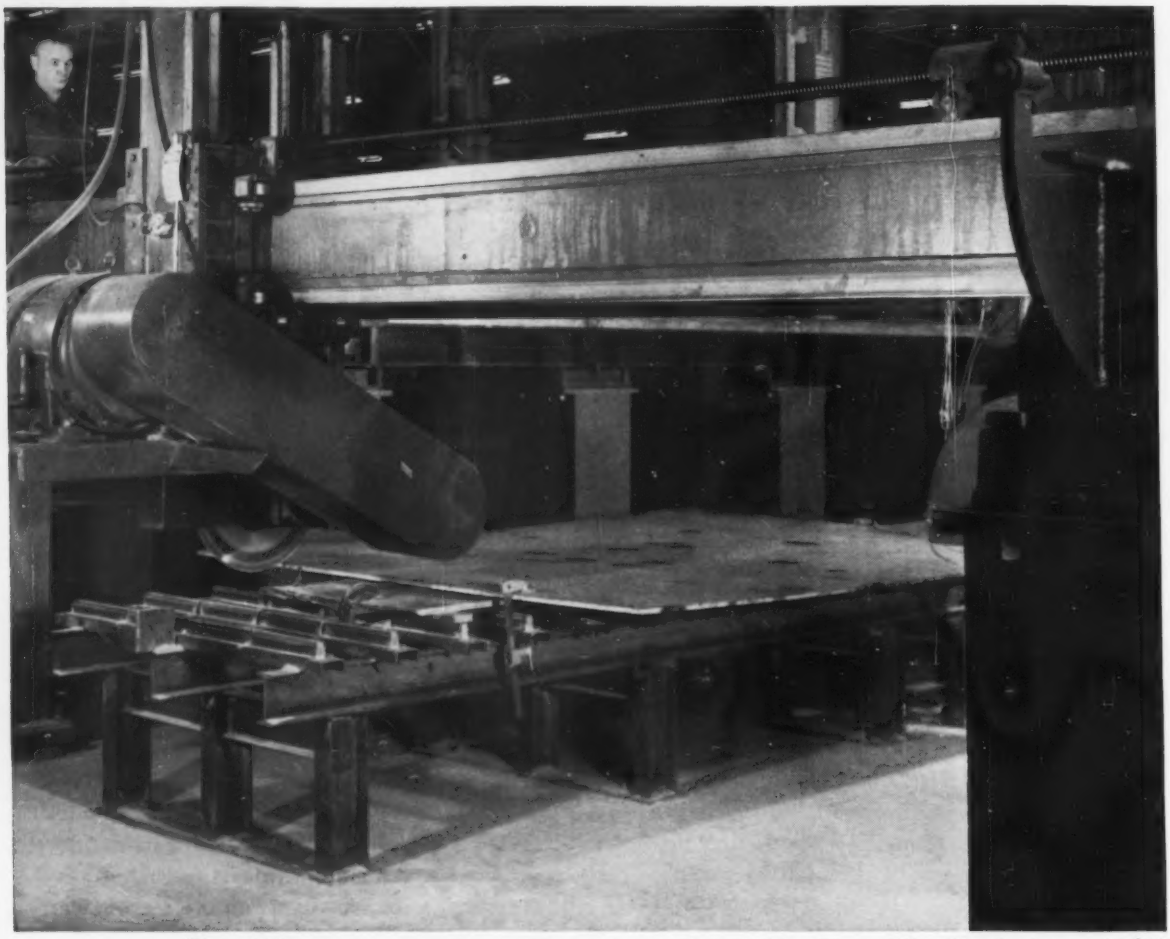
Situations of the kind outlined have been occurring more frequently with the present necessity existing throughout industry of keeping costs down to the minimum. "Do-it-yourself" is often an economical and satisfactory plan to follow, but not necessarily so when complicated devices are involved. Misapplications can cost more money than the amount that would have been involved in paying for the services of experts.

Maximum control of work quality and cost is generally attained when the manufacturer of special equipment is entrusted with the installation, servicing, and repair of his own products. Just as important, he can be held completely responsible in case of unsatisfactory performance. It usually pays to leave it to the specialists.

They have designed the equipment. They know what it can do and what its limitations are. They know just how it should be applied and what its maintenance requirements are. The purchaser of a special device should realize that its cost cannot always be measured by the initial investment.

Charles O. Herb

EDITOR



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FORGING HUGE CRANKSHAFTS

Crankshafts up to 12 feet 4 inches in length and weighing as much as 6000 pounds can be forged on a 50,000-pound, steam drop-hammer having a 130-inch long ram. Included in this unusual installation are three hydraulic presses for preliminary sizing and bending, and subsequent trimming.

CHARLES H. WICK, Managing Editor

WHAT IS BELIEVED to be the largest privately owned drop-hammer in the world has been installed at the Park Drop Forge Co., Cleveland, Ohio, for the production of giant crankshafts and other massive forgings. The steam drop-hammer, built by the Erie Foundry Co., is rated at 50,000 pounds and features a 130-inch long ram. Crankshafts weighing 6000 pounds and more, with lengths up to 12 feet 4 inches, can be produced. Three hydraulic presses, also made by Erie Foundry, were included in the recent installation for sizing, bending, and trimming the forgings. A view of this equipment is seen in Fig. 1.

The Park Drop Forge Co. has been specializing in closed-die forgings for more than fifty years. Originally engaged in the production of automotive crankshafts, the company has expanded its product variety to include component parts for aircraft, marine engines, diesel locomotives, generator sets, air compressors, pumps, machine tools, and tractors. Over half the diesel locomotives on U. S. railroads contain Park die-forged crankshafts. Addition of the 50,000-pound drop-hammer makes it possible to obtain the advantages of closed-die forging on large parts that formerly had to be made on flat dies.

Facilities include a completely integrated die-sinking shop, heat-treating furnaces, non-destruc-

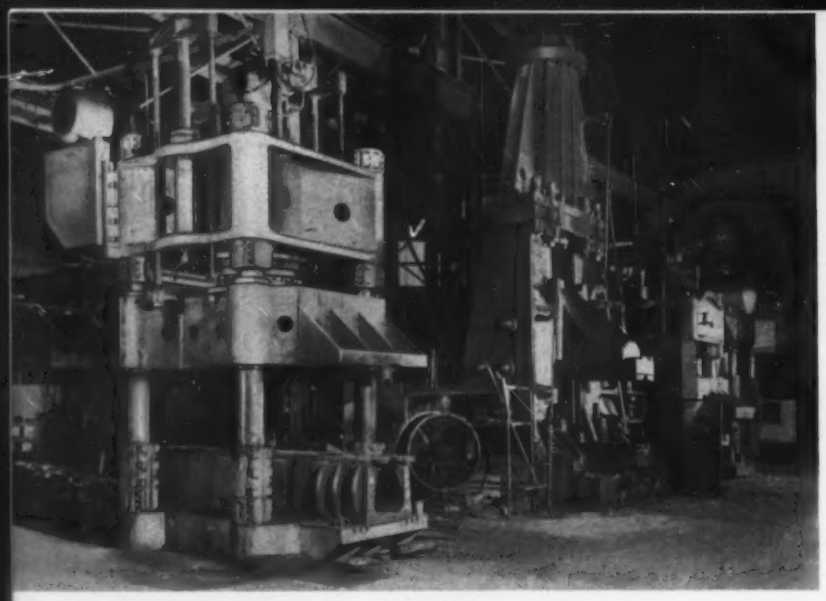


Fig. 1. Equipment for forging large crankshafts, including a 1500-ton hydraulic trimming press (left) shown next to a 50,000-pound drop-hammer.

tive inspection equipment, and a chemical-metallurgical laboratory. The laboratory facilities are used to check incoming material, control in-process manufacturing, and test the final product. Each heat of forging quality steel is metallurgically inspected and checked for chemical composition to insure soundness and conformance with specifications. Surface imperfections are removed by chipping, grinding, or scarfing.

Proper die design is essential to avoid the development of cold shuts, laps, unfilled sections, or the interruption of grain flow in the forgings. Also, the direction of the flow lines is important in developing maximum strength and fatigue resistence. Straight closed dies with only one parting plane are used wherever possible, as they are preferable to offset or locked dies having one or more changes in the parting plane, or an additional plane. On crankshafts, this means that the throws are forged 180 degrees apart. Then the crankshafts are hot-twisted after forging, on special machines developed at Park, to bring the throws into the required relation with each other.

While the normal draft angles for easy removal of the forgings from the dies have been 7 degrees for external and 10 degrees for internal surfaces, it has been possible to reduce them to 3 to 5 degrees. Also, stock allowances on the various forging surfaces have been reduced to about 3/16 inch per side, thus reducing the amount of machining required compared to conventional forgings.

Heppenstall or Finkle die-blocks, made from chromium-nickel-molybdenum, hot-work alloy steel are used for the drop-hammer dies. The blocks are forged on all six faces and hardened prior to sinking the impressions, to insure maximum resistance to impact, abrasion, and heat. A typical crankshaft and one of the dies used in forging it are shown in Fig. 2. For the squeezing (sizing and blocking) operations performed on the hydraulic presses, cast-iron or cast-steel dies are used.

One size crankshaft produced at Park for diesel-engine locomotives has a finished length of 131 inches and a shipping weight of 3544 pounds. These parts are forged from SAE 5046 chromium alloy steel. Round-cornered bars, approximately 10 inches square, are cut into required lengths, each weighing roughly 4400 pounds. The ends of the severed billets are inspected for defects before charging them into gas-fired furnaces. In the furnaces, the billets are heated to a temperature between 2350 and 2380 degrees F.

An electrically operated, driver-controlled manipulator is used to load and unload the furnace and to transfer the parts to and from the presses and drop-hammer with the ends of the billets being held by gripper jaws. Because of possible sag in the substantial, unsupported lengths of hot metal in the billets or forgings, it was necessary to provide a pivoted, swinging-arm attachment on the manipulator for supporting the parts near their mid-points.

First, the hot billets are sized on an Erie 750-ton, hydraulic forging press equipped with flat dies. In this operation, the cross-sectional area of the billet is reduced at specified locations and the over-all length increased. An Oilgear variable-displacement pump delivering 108 gallons per minute at 2600 psi is driven by a 150-hp motor. A high-speed pre-fill system permits rapid advance of the press ram at 800 inches per minute. Upon contacting the work, the ram speed is reduced to 44 inches per minute for pressing at maximum pressure (750 tons). When the pressure is reduced to 210 tons, the pressing speed is 159 inches per minute. The ram returns at the rate of 450 inches per minute.

A remote-control station is provided with all press movements controlled by a hand lever. When this lever is released, the press ram auto-

matically returns to its adjustable upstroke position. A second hand lever controls the forging speed. In addition to the main, double-acting cylinder, which is 23 inches in diameter, two double-acting side cylinders, 10 inches in diameter, are provided. The stroke of this press is 36 inches, and the opening between platens, 76 inches.

Next, the sized billets are blocked in the Erie 3000-ton, hydraulic bending press seen in Fig. 3. Generally, the part can be transferred directly from the flat-die forging press without need for reheating. Reheating is avoided whenever possible to minimize scaling, but it is necessary if the temperature of the part drops below approximately 1800 degrees F. In the blocking operation, the sized billet is squeezed into a form approximating the impressions in the drop-hammer dies —a fairly close fit being required to prevent the formation of cold shuts or laps. The result is a snake-shaped part having six 180-degree bends, one at each of the approximate throw locations on the crankshaft. A snaked forging is shown being removed from the press in Fig. 4.

The 3000-ton bending press is equipped with an Oilgear pump delivering 108 gallons per minute at 2800 psi, driven by a 150-hp motor. Ram speeds are 325 inches per minute during the advance stroke, 11.8 inches per minute for pressing, and 325 inches per minute on the return.

After reheating to the same temperature (2350 to 2380 degrees F.), the crankshaft is rough-forged on the 50,000-pound steam drop-hammer, Fig. 5. Only six steam hammers of this size have been installed in this country, and the other five are owned by the U. S. Air Force. This particular hammer is unique in that it has a ram 130 inches long and can accommodate dies approximately

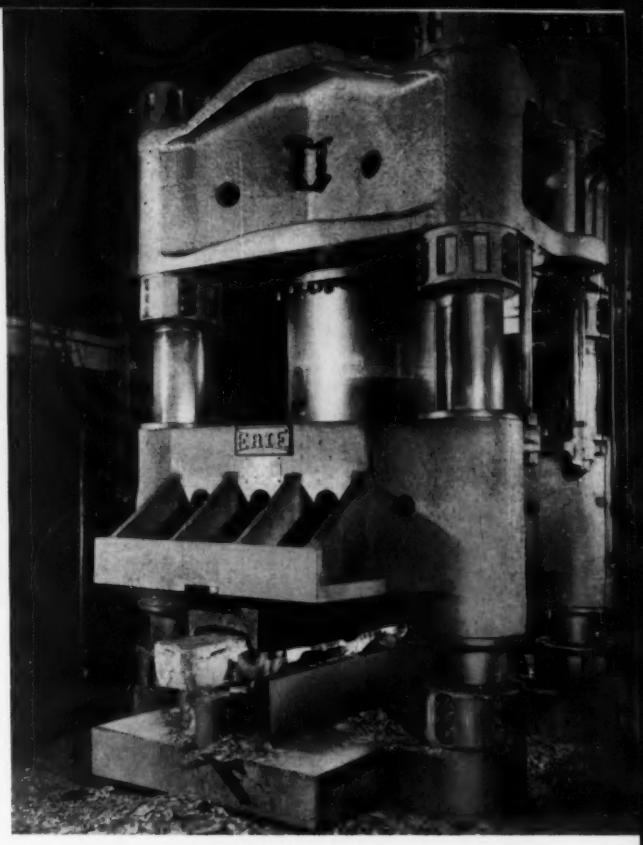




Fig. 2. (Left) Diesel-engine crankshaft 10 feet 6 inches long and one of the drop-hammer dies used in forging it. Throws are hot-twisted after forging.

Fig. 3. (Above) Sized billets, preheated to about 2350 degrees F., are blocked into a snake-shaped forging on this 3000-ton hydraulic bending press.

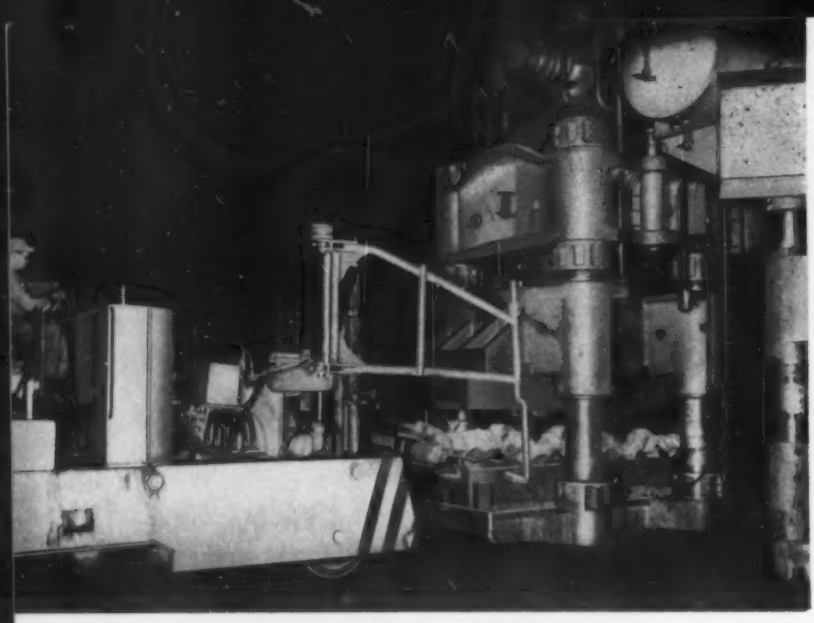


Fig. 4. (Left) Here a snaked forging is being removed from the bending press by an electrically operated manipulator before returning to the furnace for reheating.

Fig. 5. (Below) After reheating to a temperature between 2350 and 2380 degrees F., the crankshaft is rough-forged on this steam drop-hammer.

168 inches long. The three-section anvil and base, which supports the superstructure and absorbs the hammer blows, weighs one million pounds and extends 12 feet below the floor line. A special foundation, 36 feet deep by 42 feet long and 18 feet wide, was provided for the hammer. More than 1000 yards of dry, heavy-stone mix concrete was poured into the foundation.

Steam is generated in the boiler room at a pressure of 150 psi and delivered to the hammer at between 135 and 140 psi. A cylinder 9 feet long by 32 inches in diameter is provided on the hammer with a piston-rod 14 feet long and 11 inches in diameter. The cylinder is double-acting, so that the steam can be used to raise the ram (directly connected to the piston-rod), and also to supplement or moderate the gravitational force in lowering it. A stroke of 65 inches is provided, and the space between guides is 40 inches.



Oil is swabbed on the upper die after each rough-forging blow to prevent the forging from adhering to the die. The hot plastic metal is forced by the impact pressure to flow into the impressions sunk in the die-blocks. Then, without reheating, the forging is transferred by means of the manipulator to an Erie 1500-ton hydraulic press for trimming the flash. Trimming is accomplished with special tooling, the punch conforming to the shape of the forging and pushing it through the opening in a chair type die. The trimmed forging falls onto the bottom recess of the press and is removed by the manipulator and placed in the furnace. After reheating, the crankshaft is finish forged on the drop-hammer and re-trimmed.

The trimming press is equipped with an Oilgear pump delivering 71.4 gallons per minute at 2950 psi, driven by a 100-hp motor. By means of a high-speed pre-filling system, the platen can be advanced at 350 inches per minute and retracted at 325 inches per minute. Pressing, during trimming, is accomplished at the rate of 16.2 inches per minute. The main cylinder is 36 inches in diameter, and the two pull-back cylinders, 5 3/4 inches in diameter.

After re-trimming the finished forging, the crankshafts are hot-twisted on special machines to bring the throws into the required relation with each other. Then, one end of the forging is upset on an Ajax machine to form a flange 18 1/2 inches in diameter. The crankshafts are then heat-treated, and cleaned by pickling or shot-blasting. After dynamic balancing and inspection, the parts are ready for shipment.

DYNAMIC LOADS ON GEAR TEETH

In this article, the factors contributing to geometric errors in gears and the effect of these errors in producing dynamic loads on gear teeth are reviewed; equations used in the design of gear drives operating successfully at over 100,000 revolutions per minute are also discussed.

EARLE BUCKINGHAM

NO MECHANICAL PART is ever made with perfect geometrical size, form, and position of its several features; errors are inherent in its actual production. Some of these errors are direct results of varying elastic deformations of elements of the production machinery; some are the result of imperfections in the production machines on which they are produced; others are caused by varying degrees of hardness of the materials being machined. Still others are caused by the imperfect positioning of the work on the machine. The finished product contains the cumulative result of all these conditions.

Nature of Gear-Tooth Action

If the geometric sizes, forms, and positions of all features of the teeth on mating gears were perfect—and if the gears were mounted perfectly with no chance of shifting their relative positions because of operating clearances in the bearings, and if all materials were rigid—then a pair of gears in operation would transmit a smooth continuous flow of power at a constant speed and load. But none of the foregoing "ifs" can ever exist.

Elasticity

For one thing, none of the materials used for gear drives are rigid; all are elastic to a greater or lesser degree. Under the action of loads of many types, this condition leads to elastic deformations of varying amounts. Some of these elastic deformations are beneficial—in fact, the high-speed operation of any mechanism would be impossible without some deformation—but more of them are detrimental to the nature of the action between mating pairs of gear teeth. This includes the increase in the amount of error in action between the gear teeth which acts to increase the intensity of the dynamic loads; the torsional deflection of wide-faced pinions which results in a varying load distribution across the face of the gear teeth; and the bending of the gear-shafts and blanks which accentuates the varying load distribution across the face of the gears.

Types of Geometric Errors in Gears

Tooth-Spacing Errors

Spacing errors are largely a direct reflection of the inaccuracies in the indexing mechanism of the gear-cutting machine. If the index-gear on the machine is eccentric, the tooth profiles on the generated gear will also be eccentric to the same or even greater degree. This is also true of the change-gear train which drives the index-gear. The effect of tooth-spacing errors is to increase the error in action of mating gears.

Runout

The most difficult positioning feature to obtain accurately is concentricity. The amount of runout, as measured by a dial indicator, is twice the amount of the eccentricity present. On gear drives, it results in a variation in the distance travelled by the circumference of the gear, and the nature of this variation follows the form of a sine curve. In addition, it results in a static unbalance of the revolving part.

Tooth Profile Errors

Tooth profile errors will result from errors in the form of the cutting tool. On generating machines, backlash in the indexing drive often results in large form errors on one side of the teeth. The direction of the thrust of the cutting here varies as the cutting progresses—first toward the entering side, then balanced, and finally, toward the opposite side. With friction in the bearings, part of the second side of the tooth may be generated correctly; then the position of the index-head with the blank shifts with a very detrimental effect on the form of the tooth. Again, improperly sharpened generating tools may result in a marked difference in the forms of the teeth on opposite sides.

Influence of Errors on Operation of Gears

In the actual operation of the gears, all the cumulative effects of all kinds of errors present can be divided into three categories. The gear-maker must break these down into their compo-

nents in order to make the necessary corrections —but the gear user need only be concerned with the final operational results. The type of inspection which is needed by the manufacturer is often entirely useless to the final user.

The three general conditions which influence the performance of the gears are as follows:

1. Backlash
2. Runout
3. Error in action

The importance of each of these factors depends entirely upon the functional requirements of the drive. Some of them may be most essential in one case and be of little or no importance in other types of drives.

Backlash

Backlash is the difference between the thickness of the tooth of one gear and the width of space of the mating gear. It represents the amount of clearance in the drive in the same way as does the difference in size between a journal and its mating bearing.

All gear drives in continuous operation must have some operating clearance, or backlash. The heavier the loads and the faster the operating speeds, the greater this clearance must be to take care of the differential thermal expansion of the gear blanks and their housing. The temperature differences are caused by the frictional heat of operation. As long as the gears always run in the same direction, the amount of backlash is never a critical or important consideration—provided it is enough.

On the other hand, if the drive must operate in both directions—particularly if it is used for positioning or indexing—the minimum amount of backlash permitted by all other conditions becomes one of the most important factors of the accuracy or effectiveness of the drive. To satisfy the most accurate conditions possible for such a positioning drive a definite backlash takeup must be incorporated into the design. This may use split backlash-takeup gears or an entire train elastically loaded between the start and the finish of the drive.

Runout

As mentioned earlier, runout gives a varying rate of rotation to the gears, the variation following a sine curve. If the drive consists of a series of unequal change-gear ratios or a train of unequal idler gears, the final result is a series of sine curves that combine into a cumulative sine curve whose amplitude is the integrated sum of the runout of the individual pairs.

On gear drives used for positioning or indexing, runout is the most detrimental type of error of all. It should be held to the minimum possible amount. On the other hand, for power drives, a moderate amount of runout can be ignored.

Error in Action

Error in action is the total effect of all errors, primarily profile and spacing errors, that result in imperfect conjugate tooth action as the mating teeth come into and go out of contact. It is different on each pair of engaging teeth. The critical value is the maximum one. It is measured by the distance a point on the pitch line is displaced from its correct position.

An indirect measure of error in action is given by the height of the individual waves on a "Red Liner" chart or its equivalent. The true nature and amount of error in action is masked by two factors. First, the gears are meshed tightly together so that both sides of the teeth are in contact. These errors are seldom exactly the same on both sides of the teeth. Second, the gears are operating on less than their operating center distance and the conditions are such, sometimes, that the influence of fillet interference is recorded —an interference that does not exist when the gears are mounted at their operating center distance.

It is possible to make a testing machine to measure all three of these factors—runout, backlash, and error in action—on a chart similar to that made on a Red Liner. The gears must be mounted at their operating center distance; they must be driven with the contact first on one side of the teeth and then on the other. The backlash would be measured by the amount of the shift in the chart when the load was shifted from one side to the other. It would be as rapid in operation as the Red Liner. The major difficulty is that it would probably be an expensive instrument.

Errors in action are responsible for high dynamic tooth loads on gears in operation. Their influence increases greatly with increasing speeds. They are the most important factor for power drives, particularly with heavy loads and high speeds. Such errors are of minor importance in positioning and indexing drives because their influence is transient and has no cumulative effect.

Nature of Dynamic Tooth Loads

As noted earlier, the critical error in action is the largest one present. The conditions on each individual pair of mating tooth surfaces are different. The nature of the errors on one pair of teeth may allow the follower gear to fall back—those on another pair may force the follower gear to catch up again—and so on. The total distance travelled will be a constant over a period of time, but the action is more of a series of impulses than that of a smooth, steady push. This introduces a series of greater and lesser loads on the

contacting faces of the teeth. The average load will always be the transmitted load, but—as with all other averages—this is a value that never actually exists.

This intermittent gear-tooth action sets up forced vibrations in the driving and follower shafts which can be readily detected with the use of an electrical strain gage coupled with an oscillograph. Such oscillograph records will show, for gears running at moderate speeds, two peak loads for each tooth contact. At higher speeds—when there is not time for the double load cycle to act—they will show but a single peak load for each tooth contact.

Tests made on the Lewis gear-testing machine during the period from 1924 until after 1935 brought to light many interesting features of gear-tooth action. Under certain conditions of load and speed, definite evidence of the separation of the driving faces of the gear teeth was given by the breaking of an electrical circuit which passed through the gear mesh. After each such separation, the teeth came together again in an elastic impact. The dynamic load which caused the separation was christened the "Acceleration Load" and the consequent impact was christened the "Dynamic Load."

Acceleration Load

The acceleration loads occur when the entering teeth must kick the follower gear ahead to make up for the distance lost in some preceding mesh. Even with perfect gears this condition would exist because of the elastic deformation of the meshing teeth under load. An attempt was made to determine the actual acceleration at this phase of the mesh from the displacement diagrams or charts measuring the error in action, in a manner similar to that on a Saurer gear-testing machine, but without success. Friction and inertia in the recording elements prevented them from following exactly the actual motions of the gears. Again, tests made on ground master gears with different types of errors deliberately introduced indicated that it was primarily the amount of the error, rather than its nature, that controlled the conditions of separation of the teeth. The amount of this separation was known within reasonable limits so that equations were set up on the basis of work done equals work done. The acceleration loads thus determined represent the integrated average (or mean effective) of the loads acting during acceleration, and not the maximum intensity of the acceleration load. This last value may be equal to the subsequent impact load at times, but it can never be greater, because at impact all resulting changes in momentum must be absorbed in the shortest possible space of time.

To obtain a measure of the acceleration load, and the amount of work done during acceleration, some value for the elastic deformation of the teeth under load had to be obtained. Attempts were made first to determine such values analytically, but the results did not appear to be realistic. Then the charting device on the testing machine, which had a magnification of 250 to 1, was adapted to measure the relative movement of the gear blanks as various loads were applied to the teeth. From these tests, values were obtained for this factor.

The intensity of the acceleration load was determined by first determining the value of the force (f_1) needed to accelerate rigid bodies. This force varies directly as regards the amount of the masses, and with the square of the velocity.

The bodies, however, are not rigid, but elastic. In many ways, the elasticity of the members of any mechanism sets up an asymptotic condition, because, when it is easier to deform the bodies than to accelerate them, the deformation becomes the predominant factor. At infinite speeds where the momentum is infinite, all displacements are obtained by elastic deformation.

For conditions such as these, we have the law of reciprocals. When two or more influences or components are acting simultaneously to achieve a common effect, they may act in either one of two ways. For one, they may act independently of each other, in which case the resultant is the vector sum of all the components. In the other case they may act interdependently, so that what one does relieves the others of that part of the task. In this case they each do a proportionate part such that the reciprocal of the resultant is equal to the sum of the reciprocals of all such components.

For the acceleration load, the value of f_1 is the force required to do all the work on rigid bodies. The value of f_2 is the force required to do all the work by elastic deformation. The value of the acceleration load, f_a, is the resultant of the two factors where each does its proportionate part. This is determined from the relationship:

$$\frac{1}{f_a} = \frac{1}{f_1} + \frac{1}{f_2}$$

which reduces to $$f_a = \frac{f_1 \times f_2}{f_1 + f_2}$$

Separation of Teeth

Under the conditions of tests with hardened and ground gears, the amount of separation needed to break the electrical circuit through the mesh is of the order of 0.0005 inch. This value was determined by static tests. It established, in part, the amount of work performed by the acceleration load.

The setting up of an equation for the amount of separation proved to be a considerable task. The following expression appeared to be adequate, to the extent that it gave values for the separation, calculated from test values obtained by running gears under various loads at various speeds, that agreed with the probable amount of separation of the teeth. Thus, when

W = applied load, pounds;
f_a = acceleration load, pounds;
d = amount of elastic deformation under applied load W, inches;
e = measured error from chart, inches; and
k = amount of separation, inches.

$$k = \left(\frac{f_a}{W}\right) e - \left(\frac{d}{2}\right)\left[\left(\frac{f_a}{W}\right)^2 + 1\right]$$

Under static conditions, $f_a = 0$, whence: $k = -(d/2)$

Impact Load, W_d

The analysis of elastic impact was made by Carl G. Barth, a member of the ASME Special Research Committee on the Strength of Gear Teeth.

$$W_d = W\,(1 + \sqrt{1 + 2\,k/d})$$

For a suddenly applied load, the value of k would be equal to zero, whence: $W_d = 2W$.
For a static load, the value of k would be equal to $-\,d/2$, whence: $W_d = W$.

The foregoing equation appears to be a general equation for all conditions of loading where a continuous load is applied all through the impact phase. When elastic deformation is present at the start of the impact phase, the value of k is minus; hence, the resulting load is less than double the applied load. This is one of the benefits of preloading.

For gear loads, the following close approximation was developed to reduce the work of computing maximum intensity of dynamic loads:

$$W_d = W + \sqrt{f_a\,(2f_2 - f_a)}$$

High-Speed Dynamic Loads

With increasing speeds, or the use of finer pitches for the same speed, the time between successive tooth contacts becomes less. Eventually the time will become too short for the double load cycle to act. Under these conditions, there will be but a single load impulse for each tooth engagement. As the speed increases still more the time becomes still less, and the intensities of these impulses will be reduced. Regardless of the amount of the initial errors in action, the amount of the effective error in action will be controlled by the amount of change in position possible in the limited time between successive engagement under the existing conditions of mass and load. In order to reach this condition, however, the dynamic load first increases, in starting, up to a maximum value at some speed, and then reduces again as the speed increases.

When the operating conditions involve frequent starts and stops, the gears must be designed to carry this peak load of starting. When the starts and stops are less frequent, the gears can be designed to stand up under a limited number of peak loads.

It is known that the average load must be equal to the transmitted load and that the time interval for each successive tooth mesh is equal to the time between successive tooth contacts. If it is assumed that the applied load acts for the same length of time in overcoming the separating action as it does to return the teeth into full load contact again, then the condition would exist that the greatest possible effective error in action would be the distance that the applied load could move the masses of the gear blanks in a time interval equal to one-half the time between successive tooth contacts. If this distance is greater than the actual error in action, it will be assumed that the time is sufficient for the double load cycle to act.

If, on the other hand, this distance is less than the assumed or measured error in action, it will be assumed that the time is not sufficient for the double load cycle, and that the effective error in action is therefore reduced to the distance that the gear blanks can be moved by the applied load in the limited time available.

Under these conditions it is apparent that for all gear drives, regardless of the extent of the actual error, there will be a speed at which, and beyond which, the dynamic load is independent of the actual error in action. Thus, in starting, the dynamic load will reach a maximum value at some speed and then reduce with a further increase in speed. This condition has been observed in several tests of airplane gears when run at very high speeds. As noted earlier, the gears must be strong enough to carry the loads through this maximum value without failure in order to be able to operate at the higher speeds under lower dynamic loads.

The following equations have been derived on the basis of the foregoing assumptions and have been used in the successful design of several gear drives operating at very high speeds, ranging up to and beyond 100,000 revolutions a minute.

When

n = rpm of driver;
n_c = rpm of driver when e' is equal to e;
N_1 = number of teeth in driver;
t = one-half time between successive tooth meshes, seconds;

m = mass effect at pitch line of gears;
W = applied load, pounds;
e' = distance on pitch line gears can be moved in time t, inches; and
e = measured or assumed error in action, inches.

$$t = 30 \div n N_1$$

$$e' = 6 Wt^2 \div m$$

$$n_c = 30 \sqrt{6W \div em} \div N_1$$

After the value of n_c is obtained, the maximum dynamic load can be determined for this speed, using the pitch-line velocity and value of the initial error in action. For higher speeds, the value of e' is determined and used as the effective error, from which the value of the dynamic load is determined as before.

Gear Trains

Thus far, consideration has been given to a single pair of mating gears only. When a more complex mechanism is involved, consideration must be given to the influence of all other connected masses, the torsional elasticity of the connecting shafts, and so on. This is too broad a subject to be covered here. It involves an incursion into the field of the dynamics of elastic bodies. However, a rigorous analysis of this sort brings to our attention the possibilities for modifications in design that can often reduce the intensities of the dynamic tooth loads and, in addition, produce an improvement in the general operation of the mechanism.

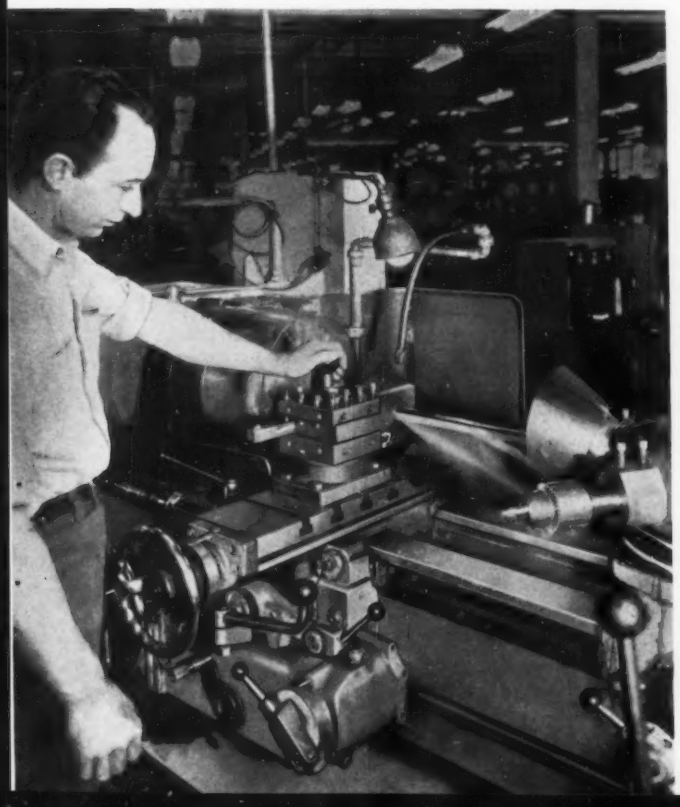
We have inherited from many different people of many different nations a remarkable and extensive fund of information in the field of mechanics and dynamics, as well as in many other subjects. Most of the information on dynamics is in the field of the dynamics of rigid bodies, with a lesser amount available in the field of dynamics of elastic bodies. Today we have before us the opportunity and the duty to extend the latter field just as far and as rapidly as our combined abilities and knowledge will permit.

Gun-Drilling on a Turret Lathe

Contrary to the belief that gun-drilling is useful only for long holes, gun drills have been successfully adapted to the production of short and accurate holes on boring machines. Furthermore, such results have also been accomplished on a standard turret lathe. Gun-drilling on a turret lathe has become the routine practice at the Hartford Empire Division Plant 3, Emhart Mfg. Co., Hartford, Conn.

One of ten different work-pieces that are machined in this way is a cast-iron part requiring a hole 14 5/8 inches long and 1 1/4 inches in diameter. The part is chucked in a Jones & Lamson turret lathe on a large, previously turned surface, and the opposite end is turned to fit the bearing of an outboard support mounted in the tool-holder on the cross-slide. Next, this end is prepared for gun-drilling by spotting, drilling, and boring a hole 1 inch deep and of the same diameter as the gun drill then used to complete the hole. The hole is drilled at 253 rpm, and a feed of 0.005 inch per revolution is used. The gun drill incorporates a Kennametal Grade K6 insert tip. The gun-drilling operation is shown in the accompanying illustration.

Holes produced by gun-drilling on the lathe are exceptionally straight and round, and the finish is excellent, having a mirror-like appearance. Scrap losses are far less than when seven separate operations were required to machine these holes. The saving in machining cost on this part is estimated to be at least $9 per part.



Gun drill equipped with a carbide-insert drill tip being used in a turret lathe to produce an accurate hole 14 5/8 inches deep in a cast-iron part.



The use of hot dies and stretch forms insures the accurate shape and size of parts made from commercially pure titanium and alloys that are hard to form.

CHARLES O. HERB, Editor

Hot-Sizing Titanium Shapes at Ryan Aeronautical Co.

SMOOTHNESS of external surfaces on jet planes is even more important today than it was with their slower flying predecessors. At the same time, the external smoothness is more difficult to achieve because of the high strength and high heat-resistant metals employed in fabricating aircraft which exceed the speed of sound.

Fuselages, doors, and other aircraft components with surfaces exposed to the air are generally backed up by shaped parts made from titanium and other alloys that are difficult to form exactly to specified dimensions. Yet, these parts must be close to size if the assembly is to be of the prescribed contour.

For example, an airplane nacelle access panel fabricated at the Ryan Aeronautical Co., San Diego, Calif., is approximately 12 feet long and has a circumferential surface as wide as 7 feet. The titanium sheet that forms the panel is only 0.016 inch thick. With all of its structural members, this panel must not exceed 150 pounds in weight. It has four hinged details. Any discrepancy of a curved rib or other component will show up on the outside surface of the panel. Therefore, if any curved surface of a rib is untrue as much as 1/4 degree, the rib is rejected. Scratches on external surfaces cannot be tolerated. Panels of this type must be interchangeable, which gives another indication of the accuracy to which a component must be manufactured.

Aprons, pylon doors, leading edges of wings, and other parts are constructed of titanium in the Ryan plant. As a matter of fact, Ryan is one of the largest users of titanium sheets and plates in this country. The metal most generally used is AMS 4901 titanium, which is commercially pure.

To insure the accuracy of titanium parts produced under hydraulic presses and drop-hammers, Ryan brings the parts close to size and shape, after they have been formed, by pressing them between heated dies for predetermined lengths of time, or stretching them over heated forms. The several methods will be described in this article.

One of the most interesting machines used in hot-sizing is the Hufford hot wrap-forming equipment shown in the heading illustration and in Fig. 1. This machine brings parts to exact size without wrinkles or deformations by pulling the parts tight over the same forms that were originally employed in stretch-forming them on a standard type of machine. For hot-sizing, the form is mounted on a vertical table heated to a temperature of 1000 degrees F., this heat being transmitted to the stretch form and the work before an operation is performed. It will be noted



Fig. 1. Attaching one end of a titanium shape that is to be sized by hot wrap-forming to a pull-head on a special Hufford machine.

that the work-piece is attached to pull-heads provided on both sides of the equipment. These pull-heads are actuated hydraulically. Thermocouples on the form block register the temperature of this tooling member.

Parts can also be stress-relieved in this setup. In such cases, it takes about thirty minutes for sizing and stress-relieving. About ten minutes are required for hot-sizing only. Approximately 600 pieces of titanium per week are handled with this equipment.

Titanium components are pressed between two die members seen on the Hannifin hydraulic press in Fig. 2 for hot-sizing purposes. This machine is equipped with a special, electrically heated platen on which the bottom die member is placed, the heat being transferred to the work and the upper die member. For this operation, as well as for all other hot-sizing performed in this plant, the dies are preheated to 1000 degrees F. This temperature is maintained while the dies are in use. Parts are held in the heated dies for six to eight minutes.

Hydraulic cylinders seen suspended at the front of the press can be mounted horizontally on some die-holding fixtures to operate sliding members required for hot-sizing a part having flanges and toggles, or other surfaces that are irregular in

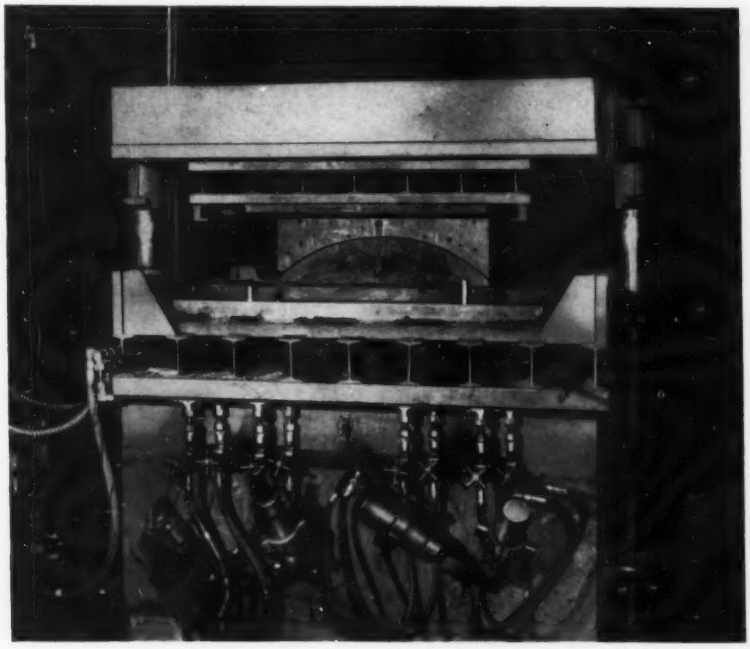


Fig. 2. Simple hot-sizing operation on a curved part being performed on a press equipped with hydraulic cylinders at the front, for operating moving members of certain types of dies.



Fig. 3. Hot-sizing operation in which a special hydraulic cylinder that can be applied in various positions along the front of the press is being used to actuate moving members of a die.

outline. In Fig. 3, the end of one of these hydraulic cylinders is seen at the front of the press.

Each hydraulic cylinder has a cylindrical extension, or pin, that fits into holes provided in blocks welded to the table fixture. The ram of the hydraulic cylinder is connected to a toggle that closes hinged members of the die after the work-piece has been loaded with its flanges and other vertical surfaces between the various die members. Thus, the hydraulic cylinder can apply pressure from several directions in the horizontal plane, while the hydraulic ram of the press applies downward pressure.

Joggles and all sorts of contours can be accurately sized to the required outline with this arrangement. The die parts must be made with an allowance for thermal expansion; otherwise, workpieces will not be produced accurately as to size and shape.

A Dake hydraulic press used in hot-sizing small components is illustrated in Fig. 4. To accommodate larger work, presses of this manufacture capable of handling dies up to 3 by 12 feet were recently installed in the shop.

Trimming of titanium parts is performed after the components have been hot-sized. For this work, it is necessary to keep the dies sharp and in all-around first-class condition.



Fig. 4. Type of equipment employed for hot-sizing smaller titanium parts in dies that do not embody moving members.

Economical Automotive Production When Quantities Are Small

PRODUCTION MEN throughout the metalworking industry have long looked to the automotive plants for the fastest and most progressive methods of mass production. Transfer machines, automatic assembly, and high-speed, single-purpose special machines of all types are commonly associated with those manufacturing establishments.

But how do automotive shops handle a low-production problem? A good answer can be found in an approach to the job of processing nine engine blocks per hour, rather than the usual 100 plus, at Ford of Canada in Windsor, Ontario.

Instead of employing transfer equipment, Ford of Canada uses some thirty-six standard and special machines to finish engine block castings ready for assembly. The machines are arranged in an elongated "U" and are served by a roller conveyor. Transfer from one machine to the next and in-and-out of machines is done manually or by cranes. Twenty-two operators are needed for maximum production.

Typical of the equipment in this cylinder block line are the four Natco machines here illustrated. The three-way machine in Fig. 1 processes thirty-three holes in the top face and front and rear ends of the block. Operations include combination drilling and counter-sinking; step-drilling; and combination drilling and counterboring.

With the oil-pan face of the cylinder block upward, the three-way machine in Fig. 2 core-drills and reams six cam bores; combination drills and countersinks two holes; and drills one hole in the pan face. Because of the low production, a two-position fixture is used. The bores are core-drilled in the first position and reamed in the second.

Rough- and finish-reaming of sixteen valve-tappet holes are accomplished with the machine shown in Fig. 3 which is provided with two angularly mounted heads. The cylinder block is manually loaded into a four-position indexing fixture. After loading, the fixture is indexed 90 degrees in the clockwise direction and the left-hand head roughs eight holes with end-cut reamers. The fixture is then indexed 180 degrees, also clockwise, after which the left-hand head roughs the opposite eight valve-tappet holes while the right-hand head finish reams the first eight. After another 180-degree indexing, the right-hand head finishes the second group of eight holes.

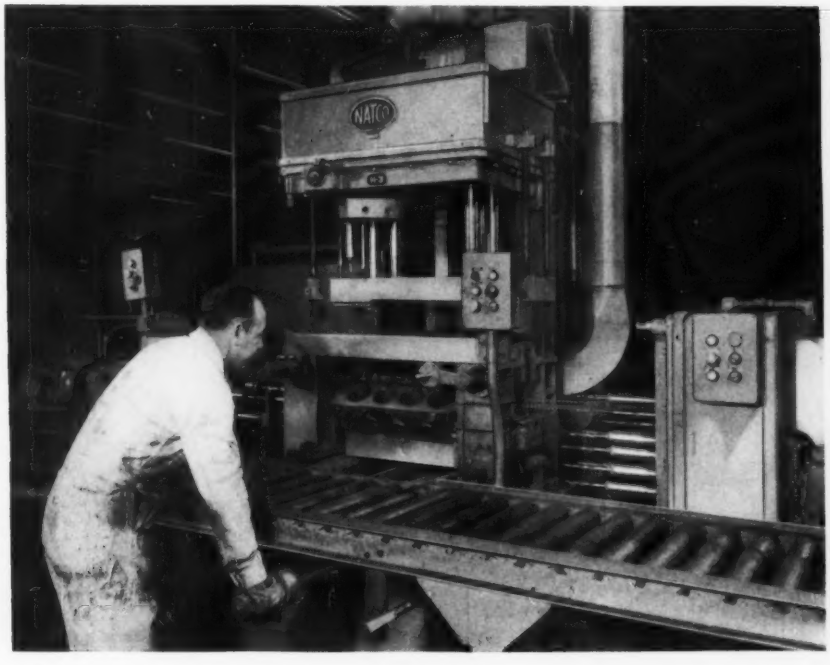


Fig. 1. Three-way Natco machine which processes thirty-three holes in the top face and front and rear ends of an engine block in Ford of Canada Plant.

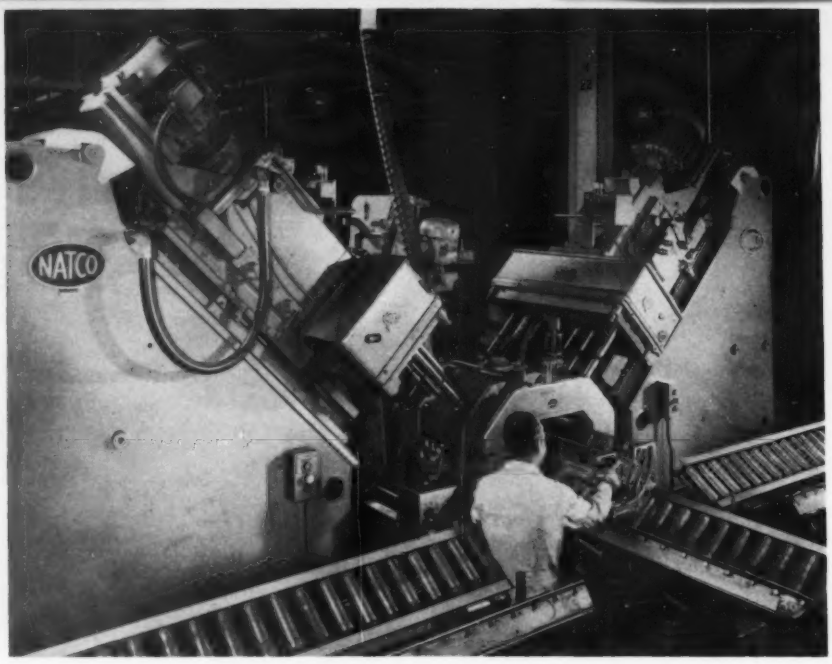


Fig. 2. Camshaft bores are core-drilled in the first position of the work fixture on this three-way machine. They are reamed in the second position.

Both tolerance and finish are important in this operation. Hole sizes must be held within plus or minus 0.0005 inch and square within 0.002 inch throughout the entire length of the hole. Although the required finish is 100 micro-inches, a finish of 22 micro-inches or better is actually obtained on the parts.

In some cases the cylinder blocks are run through the same machine twice as a further economy measure. This is true with the machine illustrated in Fig. 4. The first time through, camshaft bores are finish-bored and crankshaft bores are semifinish-bored. At the same time, distributor-body, distributor-shaft, and flywheel-housing dowel holes are semifinish-reamed. After babbitt bearing liners have been inserted by machine into the camshaft bores, the cylinder blocks are returned to the machine in Fig. 4 for finishing all holes.

An unusual means is employed to pass the long boring-bars and tools through the bushings which support them and through the rough camshaft and crankshaft bores. The block is first lowered to approximately line up the bores with the tool

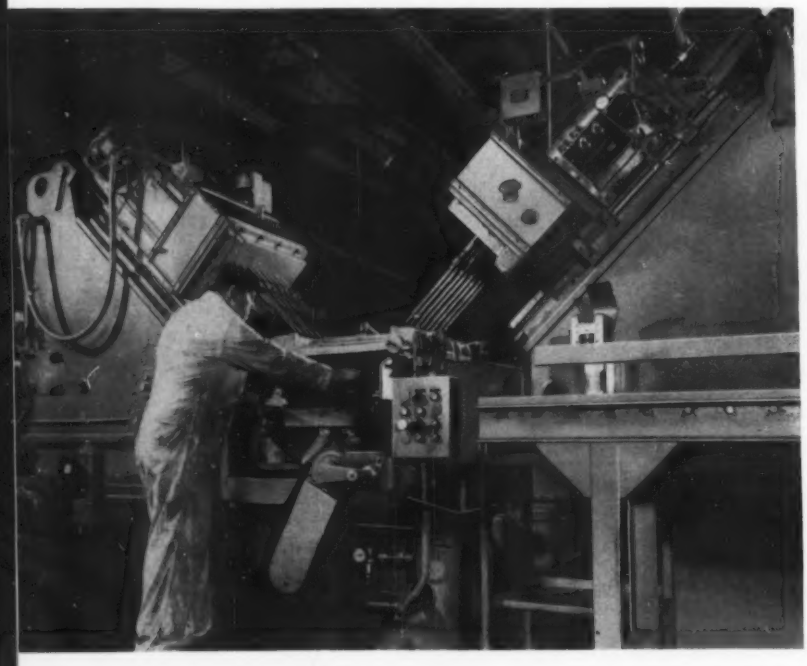


Fig. 3. Sixteen valve tappet holes are rough- and finish-reamed in this two-way machine provided with angular heads.

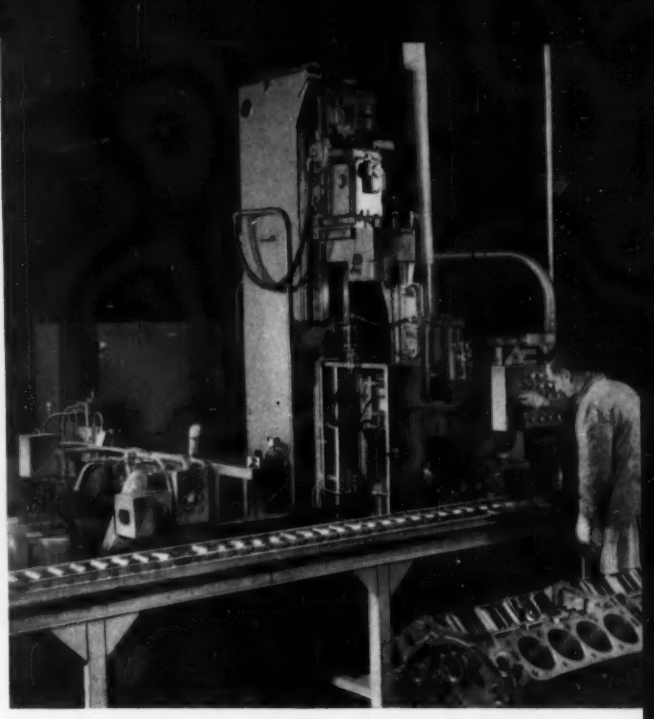
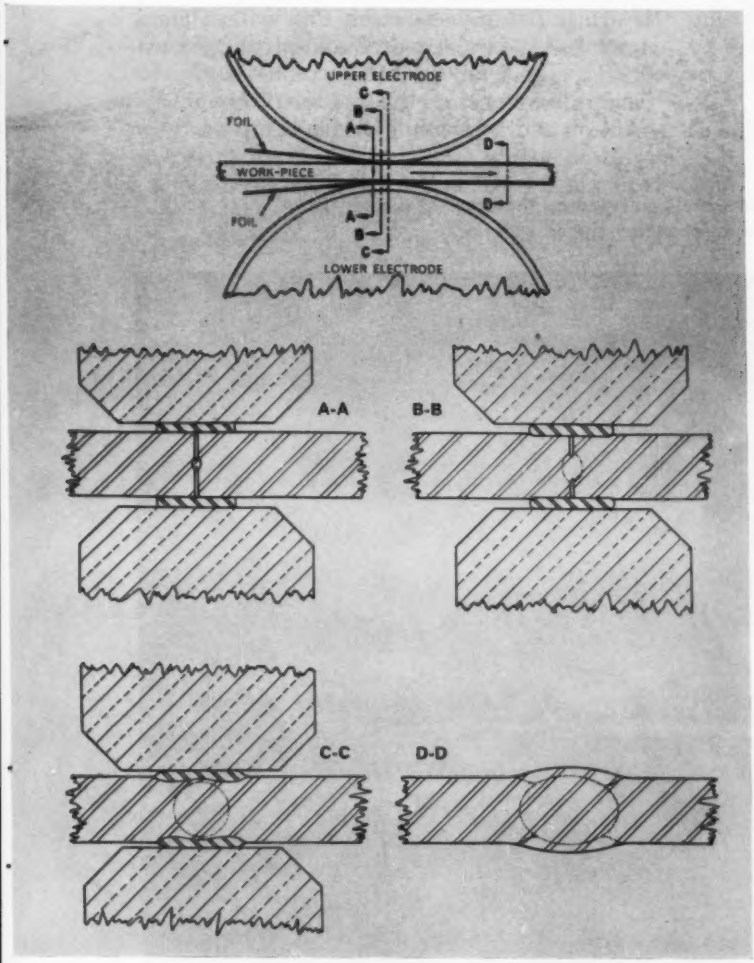


Fig. 4. Cylinder blocks are run through this machine twice, first for semifinishing camshaft and crankshaft bores, and other holes. After babbitt bearings have been pressed into the camshaft bores, the blocks are returned for finishing these bores.

bushings. The boring-bars are then radially positioned automatically so that the cutters line up with clearance slots in the bushings as the bars move into the work. During this procedure the block is so positioned that the bars move through the bores off center, thus allowing the cutting tools to pass through without marking the part.

When the tool bars are in place, the cylinder block is finally positioned and clamped with the tools lined up properly for cutting. After the cuts are completed, the entire procedure is reversed and the boring-bars retracted to their starting positions, ready for the next cycle.



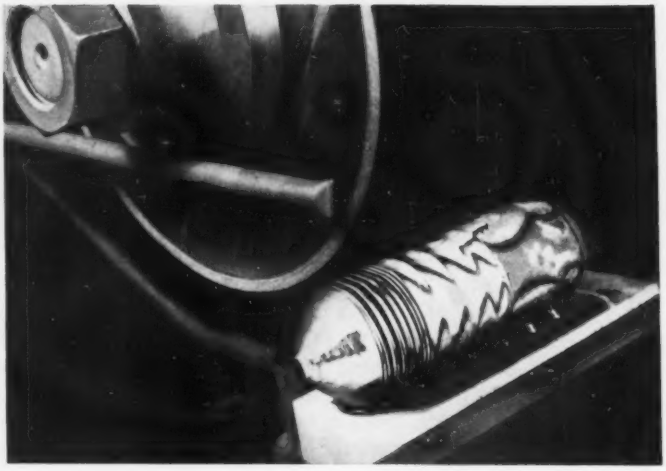
Foil Strips Are Key to Butt-Seam Welding

Foil-welding machines, used in European production for several years, are now being manufactured in this country, under license, by the Precision Welder & Flexopress Corporation, Cincinnati, Ohio. The Peco foil, butt-seam welding process yields smooth, non-overlapping seam welds of dense structure and high strength. Welds have been made on 0.078-inch thick stock at speeds of 3 to 24 fpm. The process is applicable to mild, low-alloy, high-carbon, and stainless steels.

In the process, a thin strip of foil is introduced on each side of the seam to be welded (see illustration). The foil acts as a bridge to distribute welding current to both metal sheets and prevents too rapid a withdrawal of heat from the joint area. Also, the foil strip offers added electrical resistance and helps contain the molten weld nugget. Sheets are generally clamped and, in some cases, the foil is spot-welded at a lower heat prior to seam welding.

Strips of foil are sandwiched on either side of the butt joint as it is being fed between roller electrodes to facilitate formation of a continuous seam weld.

Slicing and Dicing Crystals of Silicon and Germanium



While full details on the manufacture of crystals for electronic systems are considered proprietary, much available information is here presented.

SILICON AND GERMANIUM crystals for application in military, airborne, and industrial electronic systems and controls are produced in large quantities by the Semiconductor Division of the Hughes Aircraft Co., Culver City, Calif. Ingenious methods have been developed for mass-producing these parts to dimensions of 0.035 inch square by 0.013 inch thick within a tolerance of plus or minus 0.002 inch.

The Hughes Process Engineering Department was handed the job of determining how crystals could be economically made on a production basis back in 1956. First was the problem of "growing" single-crystal silicon and germanium from raw material. Second, there was the problem of slicing these materials into extremely thin wafers. Third, means had to be devised of gold-plating the wafers. Finally, a process had to be developed for dicing the wafers into the small particles.

Silicon and germanium elements are nearly as

Fig. 1. Forty Diatronic diamond wheels mounted on the arbor of a modified grinding machine for dicing silicon wafers.

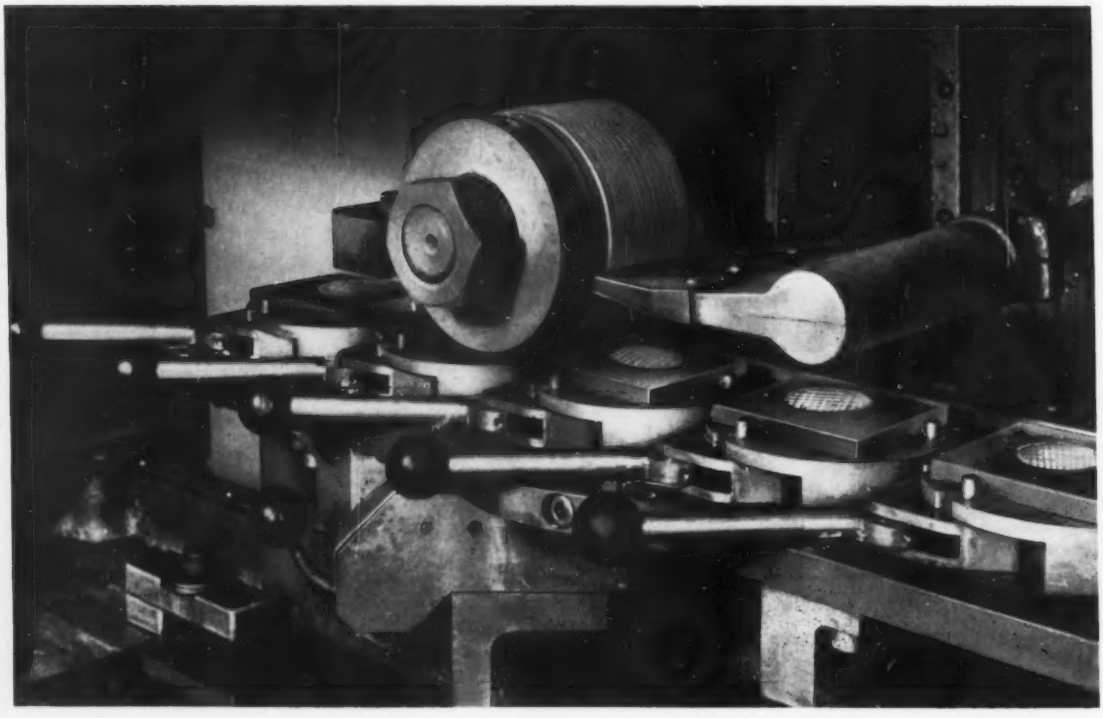




Fig. 2. Piece of single-crystal silicon, a wafer that has been sliced from a similar piece, and a diced wafer still held on its cutting block.

hard as diamonds. It was decided, therefore, that the cutting job was one for diamond wheels. But in 1956, precision diamond wheels were not available in quantities that would accurately produce such small silicon and germanium slices, nor were these machines that had been designed especially for this class of work. Also, there was no data concerning suitable production feed rates or wheel speeds. Water was the recommended coolant.

Practically all that was really known was that silicon and germanium had become "essentials" to the electronics industry. This first became apparent in 1950 when research men in the Bell Telephone Laboratories found a method of growing these materials in single-crystal form. Single crystals of silicon and germanium, when properly treated, permit the passage of electrical current in one direction only. They replace vacuum tubes, rectifiers, and other conventional parts with great savings in weight and great reliability.

The Hughes concern spent about five years investigating the electronics properties and capabilities of silicon and germanium, and in developing the present crystal manufacturing methods. Out of this research came a modification of DoALL surface grinders that accommodate a single, 6-inch diamond wheel for slicing and forty 3-inch wheels on a single arbor for dicing.

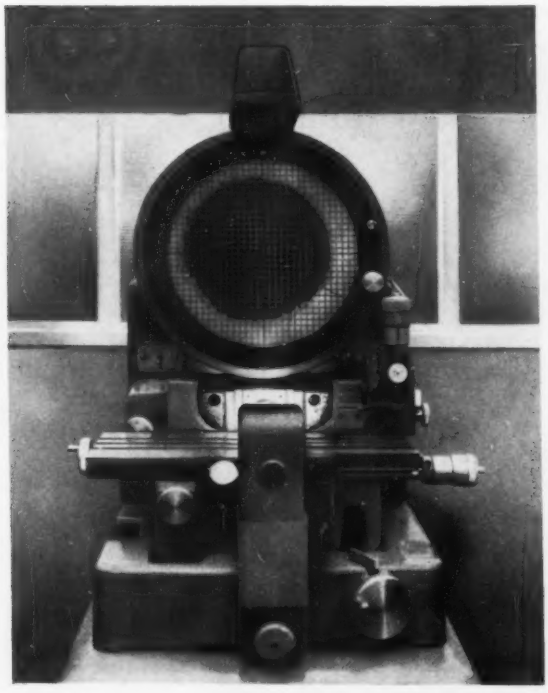


Fig. 3. Checking a diced slice of silicon crystal on a Kodak contour projector to determine the accuracy of the multitude of small crystal parts that will be later assembled into electronic equipment.

The heading illustration shows a piece of silicon approximately 1 1/4 inches in diameter by 4 inches long being cut into 0.013-inch thick slices by the application of a 6-inch diameter wheel. In Fig. 1 forty cuts are being taken simultaneously across one face of sliced discs mounted in fixtures on a table that is traversed longitudinally beneath the grinding wheels. After one traverse of the table, all fixtures are indexed 90 degrees so that the crystals are cut into small squares with the second table traverse. Today, a DoALL Microtomatic machine is also available for this specific purpose.

In Fig. 2, a piece of grown silicon is seen at the left, and then to the right, a typical wafer cut from such an original piece. Above the wafer is seen one of the plastic holding blocks in which the wafer is mounted for the dicing operation. The pencil gives an idea of the size of the various parts.

After the first cut has been taken on a setup of crystal wafers, the accuracy of the operation is checked by mounting a marked crystal on a Kodak contour projector as shown in Fig. 3. This inspection is performed to make certain that the grinding wheels and the wafers are in true alignment. A Hauser toolmaker's microscope is used to measure any deviations so that corrections in the machine setup can be made. A Starrett micrometer is employed to check the accuracy of the slices. The gold-plating is also checked for quality and for thickness.

Finding a satisfactory diamond wheel turned out to be a more difficult problem than modification of an existing machine for the slicing and dicing operations. First of all, the diamond wheels had to be thin to economically cut the single-crys-

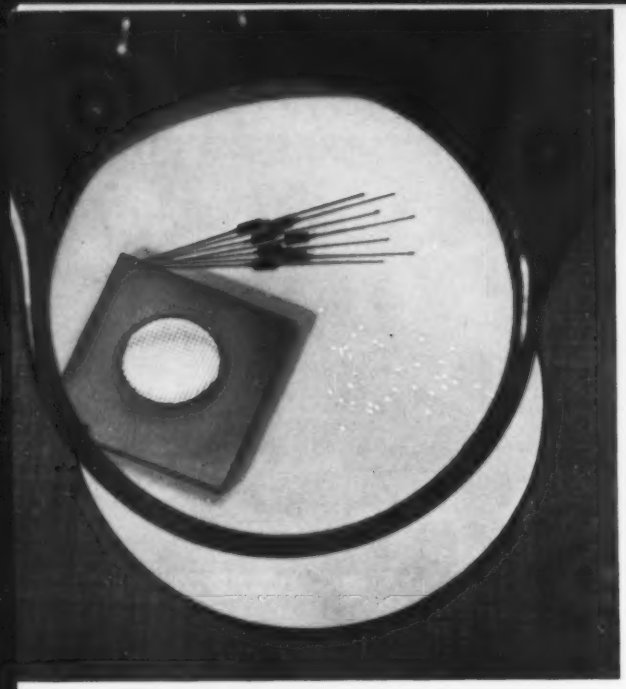


Fig. 4. Observed through a magnifying glass, silicon chips 0.035 inch square, diodes in which these chips are assembled, and a diced slice of silicon.

tal material, because silicon, for example, costs approximately $3000 a pound. With a diamond wheel 0.008 inch thick, the silicon loss in the form of dust is about 65 per cent. Furthermore, production schedules necessitated that the wheel be strong and replacements be quickly available. Diamond grit in the cutting edges of the wheels had to be evenly distributed so that scratching and unevenness on the diced silicon parts were reduced to a minimum. Finally, the wheels had to be consistently precise.

Available diamond wheels were intended primarily for grinding rather than for precision cutting. Hughes tooling engineers collaborated with diamond-wheel manufacturers to obtain wheels that met the stringent specifications. The latest wheel to win approval is called the "Diatronic" and is a product of Navan Products, Inc., International Airport, Los Angeles 45, Calif. Wheels of this brand are 0.006 inch thick and are guaranteed to be accurate as to the width of their cutting edge within plus 0.0005 inch minus 0.0000 inch.

These wheels result in a reduction of the dust loss of the $3000-a-pound silicon to about 45 per cent. Replacements are available on twenty-four-hour notice and wheels with varying grit specifications can be produced within forty-eight hours. Five months of testing were performed before Hughes was satisfied with the new wheels, which gives some indication of the extensiveness of test programs in this company. A detergent coolant was found to be the most satisfactory.

Production-line procedure has been established which today is supplying diodes, transistors, and other parts for electronic computer products, including aircraft and missile guidance systems. In Fig. 4 are seen some scattered diced crystals and a group of typical diodes in which the crystals are assembled.



Jig-boring operation on a Sip machine in a Compton, Calif., plant of Autonetics, Division of North American Aviation, Inc. A considerable number of holes of widely different diameters were bored in an aluminum plate that serves as a three-piece gear-case. At the time that the photograph was taken one of the holes was being counterbored.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Liquid Detergent	**Acoustica Ultrasonic Cleaner No. 715**	A liquid detergent for accelerating the cleaning of metal objects. It is a water-based detergent suitable for use with all types of ultrasonic cleaning systems.	For cleaning objects such as lenses, precision parts, surgical instruments, ball bearings, and clock type mechanisms.
Aluminum Alloy	**Alcoa Alloy 5456**	A non-heat-treatable alloy which in the H321 temper has a tensile strength of 51,000 psi, a yield strength of 37,000 psi, and an elongation of 16 per cent.	Available in plate form, it has marine and structural uses. Gun mounts, carrier elevators, and deckhouses have all been fabricated from this material.
Die-Casting Alloy	**Alcoa Alloy X385**	The tin, lead, and cadmium in the alloy provide a combination of good casting characteristics, mechanical properties, and bearing qualities.	This alloy will permit integral bearing surfaces instead of cast-in or specially assembled bearings or bushings in aluminum die-casting designs.
Aluminum Alloy	**Alcoa Alloy X5454**	This high-strength aluminum alloy can be used continuously or intermittently at temperatures of from 150 to 300 degrees F. Resists corrosion and stress corrosion in all temper specifications. Tensile strength ranges from 36,000 to 49,000 psi.	Developed especially for welded aluminum structures which must operate at moderately elevated temperatures. Used in those industries where chemicals are handled at elevated temperatures.
Abrasive Tread Plate	**Alcoa Aluminum Stair Tread**	A tread plate of fused aluminum-oxide abrasive bonded to aluminum to provide a rough, slip-proof front surface. It is available in various finishes.	Designed for use in industries where extreme weathering or corrosive atmospheres are encountered, to provide a safe footing.
Aluminum Iron Alloy	**Alfenol**	This alloy combines high permeability and high wear resistance.	It is available in strip form as thin as 0.025 inch for applications requiring a soft magnetic material.
Casting Alloy	**Almanite**	An alloy which combines the properties of austenitic manganese steel and martensitic white irons and has a tensile strength of 90,000 psi with a ductility of 15 per cent. Can be machined with difficulty.	Can be cast in all forms and shapes and has been used for making mill liners, grinding balls, crushing rolls, sprockets, bushings, chutes, guides, and mixer blades.
Welding Flux	**Ampco-Braz Flux No. 2**	This flux has good wettability, is non-fuming and non-toxic, has ability to depress filler metal bubbling and fuming, has deep penetration, and dissolves and removes oxides formed.	For general brazing, cast-iron welding and cast-iron brazing when used in conjunction with the oxy-acetylene process.
Fusion Joining Wire	**Ampco-Trode 160**	A spooled wire form for joining and overlaying with the inert-gas consumable-electrode process. Tensile strengths up to 100,000 psi and hardnesses of 190 to 220 Brinell are exhibited.	Recommended for joining high-strength, hard aluminum bronzes such as Ampco Metal grades 16, 18, and 20.

For names and addresses of manufacturers of products listed, see end of this section

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Soldering Flux	**Anchor No. 302**	This organic-base flux that is highly active yet non-corrosive can be used to remove oxides from stainless steel, steel, nickel, and nickel-chromium alloys.	Available in a ready-to-use concentrated form. It may be used full strength or diluted for the soldering of many metals.
Powder Metals	**APM Alloys M257, M430, M470**	These powder metals are available in the form of extruded shapes, forgings, sheet, foil, drawn and extruded tube, impact extrusions, fasteners, and wire. They can withstand temperatures up to 900 degrees F. and can be anodized and electroplated.	Applications include honeycomb sandwich structures, hot-air valve housings, airborne heat exchangers, and fasteners.
Shim Stock	**ASC Micro-Shim Stock**	This ultra-thin shim stock is rolled to thicknesses accurate to 0.0001 inch. It is available in stainless steel, brass, and low-carbon steel.	Designed to eliminate costly and time-consuming precision machining operations, particularly in miniaturization applications.
Layout Fluid	**Beechem Layout Fluid**	This compound is resistant to water, oils, and trichlorethylene, and is not affected by humidity.	For laying out lines, etc., on metal parts. It dries rapidly with little glare, is tough, and adheres well.
Vinyl Sheeting	**Boltaflex 500**	This semi-rigid vinyl sheeting will resist wear, staining, cracking, chipping, peeling, delamination, atmospheric and salt-water corrosion and fire.	Available in six colors and many embossings for vinyl-to-metal applications.
Mastic Adhesive	**Bondmaster G458**	This high-strength, fast-drying, trowellable mastic for bonding foam plastics resists humidity, has no offending odor, and withstands low temperatures.	Applied with a saw-tooth spreader, notched trowel, or spatula, it has been used in the fabrication of rigid sandwich panels with foam styrene cores in heating systems.
Wear-Resistant Steel	**BR-4 Steel**	Supposedly the most wear-resistant steel known to man.	Used for plow and pug-mill tips for use in mixers and pug mills.
Stop-Nuts	**Brilok Nylon Stop-Nut**	A self-tapping hexagonal nut with locking and sealing features. Thread forms a seal against liquid or gas escape, or the entrance of corrosive influences.	May be obtained also in the half- or fully tapped form. For applications involving the use of stop-nuts.
Gasket Material	**Color-Plast**	This shim and gasket material, which is color-coded to identify the different thicknesses available, is impervious to oils and grease, even at elevated temperatures.	Applications include bearing-cap shims, milling-machine spacers and hydraulic cover gaskets.
Electrical-Contact Cleaner	**Cramolin**	This cleaner decreases contact resistances, reduces sparking of brushes on commutators, and will not absorb moisture. It operates in a temperature range of from —40 degrees F. to +302 degrees F.	Cleans, preserves, and lubricates electrical contacts of all types. Metals on which it may be used include copper, brass, bronze, nickel, and gold and silver alloys.
Metal Coloring Ink	**Crown Toolmaker's Ink**	This ink, which contains no acid, will not flake or peel, is heat-resistant, and is readily removed with lacquer thinner.	A dyeless, pigmented ink which provides coloring for sharp, clean scribing of metals, glass, etc.
Titanium Alloys	**Crucible B-120VCA, C-105VA, C-115AMoV**	B-120VCA, a beta-titanium whose yield strength of 120,000 psi can be increased to 200,000 psi by aging. C-105VA, an alpha-beta titanium that has high strength, is formable and weldable. C-115AMoV can be aged from a soft, easily formed condition to high strength with useful ductility.	For use wherever high-strength, easily formable titanium alloys are required in the form of sheet, wire, and small bar form.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Lubricating Oil	**Custom Lube 101L**	This oil has a life of fifteen years during which there is no gumming or oxidation. It prevents wear under extreme loads.	For the "lifetime" lubrication of instruments, meters, and precision machinery.
Epoxy Resins	**D.E.R. 332** **D.E.R. 331** **D.E.R. 334**	The 332 formulation is water-clear, has good uniformity, and a very low viscosity. The 331 formulation is a standard, unmodified resin, and 334 a modified low-viscosity resin, used for laminating.	These three basic resins should be of special interest to the tooling, electrical, paint, adhesive, reinforced-plastic, and chemical industries.
Wear-Resistant Material	**Devcon WR**	A wear-resistant material which can be cast without heat or pressure. It is resistant to most acids, alkalies, and solvents.	For use as guides on machinery, low-speed bearings, built-up surfaces subject to severe wear, etc.
Adhesive	**Eastman 910 Adhesive**	This adhesive, when placed between two materials and allowed to set for 30 minutes, will support 5000 pounds.	Used on similar as well as dissimilar material, such as metals, plastics, wood, and glass.
Adhesive	**EC-1368**	A versatile elastomeric-base adhesive that produces high-strength bonds between a variety of laminating materials without use of pressure.	Used to bond decorative plastic laminates to metals, and plastic, steel, or aluminum facings to paper honeycomb cores in non-load-bearing sandwich-panels.
Epoxy Resins	**Eccobild 121, 127, 420, 470, 430, 490**	These resins are lightweight, heat-resistant, have variable resiliency, and in some cases are dimensionally stable.	For industrial tooling applications such as molds and jigs, die-facing material, and lightweight molds and dies.
Metal Cleaning Processes	**Enbond Z** **Enbond BR**	The first process is for the treatment of zinc-base die-castings, and the second for the preparation of brass and other copper alloys for any type of electrodeposit.	These processes offer a complete cycle for cleaning and preparing several metals in order to give maximum adhesion of various plated coatings.
Honeycomb Filler	**Epofil B-1**	This material is a hot-melt, waxlike substance which is quite easy to remove from the metal honeycomb after the machining operation.	For filling stainless-steel and aluminum honeycomb preparatory to contour-machining.
Barrel Finishing Compound	**Esbec No. 234**	This compound removes rust, oxide stains, and light heat-treat scale in fifteen to forty-five minutes.	This neutral, powdered, non-abrasive compound is used to burnish metal parts.
Plastic Material	**Fast-Line**	This material, 0.050 inch thick, is used for comparator chart gages. It is stable with respect to temperature and humidity changes and is rated next to glass as a chart layout material.	Material comes with either a clear or matte surface in sizes to fit all makes of optical projectors, on which it is used to make comparator chart gages.
Insulator and Refractory	**Foamsil**	An acid-resistant, insulating, and refractory material made of 99 per cent pure fused silica which will neither oxidize nor absorb moisture. Withstands thermal shock within the range of from minus 450 degrees F. to plus 2200 degrees F.	May be used as a lining inside pipelines, dipping vats, electrolytic and pickling tanks, and electric and heat-treating furnaces.
Rust Preventive	**Froil**	A rust-preventive oil which combats water spotting of highly polished, machined metal parts after alkali or emulsion degreasing and rinsing, and after water-cooling. Prevents corrosive attack due to fingerprints.	Parts which may be treated include precision parts, dies, tools, instruments, and gages.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Protective Coating	**Galvinoleum**	These coatings, available in red, gray, green, and metallic colors, may be applied right over new unpainted galvanized aluminum or terneplate surfaces.	The coatings are used on gutters, downspouts, siding, roofing, and heating and ventilating ducts.
Silicone Fluid	**General Electric Fluid 81743**	This water-clear fluid, available in viscosities of 5, 10, and 20 centistokes, is highly resistant to shear breakdown and possesses unusual chemical resistance.	This fluid is used as a damping medium in vibration dampers and shock absorbers, and as a hydraulic fluid in servomechanisms and control devices.
Bearing Lubricant	**Grades ETR Grease B and ETR Grease D**	These greases have an operating temperature range of from minus 45 degrees F. to plus 600 degrees F. They are water-resistant, stable, and have a low evaporation rate.	Developed to meet the high-temperature lubrication requirements of supersonic aircraft and missiles.
Gear Lubricant	**Graphilm Industrial Lubricant No. 702**	A gear lubricant which can be poured out of a can like oil, but adheres to the gear like grease. Contains natural flake graphite which will not settle, cake, or harden.	Developed primarily for open gears, but can also be used on roller chains and other applications.
Cutting Oil	**Gulfcut Heavy-Duty Soluble Oil**	An emulsified cutting oil that combines the cooling ability of water with the lubricity and protection of oil. It does not foam, is highly resistant to oxidation, and will not gum on ways, slides, or other machine parts.	For heavy-duty machining and grinding operations, including heavy hogging cuts, fast fine cuts, boring, and grinding of ferrous and non-ferrous metals and alloys.
Ceramic Coatings Process	**Gulton Ceramic Coating Process**	This process coats aluminum alloys to withstand temperatures of 1300 to 1350 degrees F. without collapsing. The coated alloys can be bent, drilled, and punched.	For coating so-called "strong," structural aluminum alloys.
Steel Alloy	**Hardsteel HD-27M**	A tough, high-strength alloy that maintains its edge strength and has a low coefficient of friction. Cutting tools made of this material may be operated at high speeds with heavy feeds.	Besides cutting tools, other applications are lubrication-free bearings, grinding rests, lathe centers, dies, gages, and spinning tools.
Sintered Metal Ceramics	**Haynes Metal Ceramic LT-1, LT-1B, LT-2**	These metal-ceramic materials have good high-temperature mechanical properties and high resistance to corrosion over a wide temperature range. They are made by casting to shape, sintering, and machining or grinding as required.	Uses of these cermets include thermocouple protection tubes, and valves for very high temperature applications. One is also being used experimentally for rocket nozzles on guided missiles.
Die Steel	**Hedervan**	This steel has a wear resistance twice that of ordinary water-hardening carbon steel currently used in the fastener industry for cold-heading applications.	Used for cold-heading dies, cold-striking dies, embossing dies, coining dies, draw dies, and punches.
Alloy Steel	**HY-80 T-1**	The first of these steels is weldable for constructional use. The second has a slightly higher strength. Yield strengths range from 80,000 to 95,000 psi and elongations in 2 inches are about 20 per cent.	These high-strength alloy steels available in plate form are for structural, pressure vessel, and general machinery use.
Iron-based Alloy	**J-1300**	A precipitation-hardening, iron-based alloy with good strength-to-weight properties in the 1300-degree F. range. Tensile strength at 1200 degrees F. is 135,000 psi. It is ductile and easily forgeable between the temperatures of 1700 and 2100 degrees F.	Supplied in the form of forgings and bar stock, it is used for jet-engine components such as turbine wheels, rings, shafts, and compressor wheels and blades.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Protective Wax	**Johnson's Wax-Plate No. 6143**	A product formulated to protect metal surfaces during inside storage and short periods of outside storage. It has a low viscosity and a flash point above 100 degrees F.	Used for coating metal springs, taps, machined parts, hand tools, and metal and chromed parts of motor vehicles and appliances.
Penetrating Oil	**Kano Kroil**	This material dissolves gum, rust, and other corrosion deposits and supplies proper lubrication while loosening frozen metal parts.	For loosening frozen pulleys, bearings, nuts, bolts, pipe threads, and screws. It can also be used for lubricating air-driven tools.
Tungsten Carbide	**Kenface**	A cemented tungsten-carbide product which is used either as a hard-facing material or as a cutting material.	Used for cutting hard rock. Hard-facing applications include power shovel teeth and road scraper blades.
Hard-Facing Plates	**Kenplate**	A hard-facing material of hexagonal plates of cemented tungsten carbide assembled on an adhesive, glass-fiber backing. Backing holds plates in position while they are being bonded by epoxy adhesives, silver solder, or conventional brazing materials.	Applications include wear plates for mills, liners for ball mills, chute and mold liners for abrasive materials, and facings for machine tool ways.
Gear Lubricant	**Keystone 122C-5X**	This product possesses a high film strength, provides lubrication under extreme operating pressures, and exhibits a high resistance to thinning out under heat and pressure.	Lubricant is used to arrest gear wear and reduce noise in metal-working press applications.
Coating for Patterns	**Krylon**	A sprayed-on coating which permits easy drawing of patterns from sand molds in foundries.	Used in foundries for spraying a thin coating on patterns to give a resilient surface impervious to the action of oils and other substances in the sand.
Vinyl Paint	**Lankote 200-H**	This vinyl paint, which can be sprayed thickly in one pass, gives a high-gloss, corrosion-resistant, fast-drying, vinyl coating to ferrous metals. The coating is flexible and abrasion resistant.	Available in eight colors. It has good flow-out and brushability, and adheres well to ferrous metals.
Resin Molding Compound	**Lexan**	A polycarbonate-resin molding compound, which offers a combination of toughness and heat stability, has a high impact strength, low water-absorption, a 280- to 290-degree F. heat-distortion point, and good electrical properties.	Manufactured in the form of cylindrical pellets suitable for molding such items as gears, automotive parts, housings, rollers, electronic parts, and telephone accessories.
Abrasive Finishing Compound	**Lorco 3X**	A fast-acting, abrasive finishing compound that removes films or skins on die-cast parts, and similar work-pieces.	May be used with any chemically inert media, or in self-tumbling of ferrous as well as non-ferrous metals.
Burnishing Compound	**Lorco Lustre-All**	This material can be used effectively on metals and alloys and leaves no film of any kind. It will work equally well with various coloring or burnishing media.	For coloring and burnishing, it imparts a high gloss and a virgin-metal color to any metal or alloy.
Steel Alloy Plates	**Lukens Nine Nickel**	Has a minimum tensile strength of 90,000 psi and a minimum yield strength of 60,000 psi. This plate, which also has high impact resistance, can be welded using established techniques and available electrodes.	Used wherever an alloy plate with high impact resistance and a high strength at temperatures as low as −320 degrees F. is required.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Synthetic-Leather Coating	M & T Amorhide	A rich, leather-grained appearance can be obtained by spraying this material over a special primer, and curing. Resultant coating is resistant to moisture, perspiration, acid, alkalies, and other corrosives.	Available in a wide selection of colors, this material absorbs shock without chipping or cracking. It is used for applications such as cabinets, luggage, etc.
Casting Resin	Maraset Resin No. 639	Available in four formulas, this material sets at room temperature and lends itself to a combination of a room temperature and short oven cure. It is odorless, dimensionally stable, resistant to chemicals, and has good recovery characteristics.	This material, which adheres firmly to plastics, metals, ceramics, etc., has been used for gasketing and mold-making applications, and also to face drop-hammer dies for multiple stamping of metal panels.
Metal-filled Resin	Metalset A4	An aluminum-filled epoxy resin which is water- and oil-proof, resists acids and alkalis, and is nonflammable. Can be machined, and will withstand considerable mechanical shock.	Used as a patching material for metals, wood, plastics, and concrete, and as a repair cement for leaking tanks, pipes, conduits. It can also be used as an adhesive.
Adhesive	Metex	A nonflammable adhesive for bonding leather, wood, fabrics, paper, felt, and other porous materials to metal. The resulting bond is permanently flexible.	Uses include the covering of radio and television cabinets with leather or decorative fabrics.
Skin Lotion	Milburn's Ply No. 9 Liquid	Lotion contains corrosion-resistant ingredient which prevents spotting of highly finished metal surfaces by contact with workers' hands. Lotion film is impervious to kerosene and petroleum type cutting oils.	Developed to meet spotting problems encountered in machining and inspection operations on delicate metal parts such as bearings, aircraft instruments and electronics parts, and parts for plating.
Ground Stock	Milford Precision Ground Flat Stock	This ground flat stock which is available in the oil-hardened and air-hardened types has a fine velvet finish. The flat surfaces are parallel and straight, and the edges are ground parallel and square to the ends.	Applications include a great variety of tools and gages.
Titanium Alloys	MST 2.5Al-16V MST-821	The yield strength of the first may be as low as 50,000 psi. After aging it has a tensile strength of 165,000 psi, a yield strength of 150,000 psi, and an elongation of 5 per cent. The second alloy retains its strength at a high temperature.	The 2.5Al-16V titanium alloy sheet that can be readily formed and then heat-treated to high strengths is used for fabrication of parts requiring severe forming. The other alloy is a weldable sheet and bar material.
Metal Finish	Nero-Zinc	A green-colored solution which produces a deep, lustrous black finish on plain zinc die-castings and zinc-plated parts.	Ideal for camera or instrument components where non-reflecting surfaces are required. Also used for color identification purposes.
Carbide	NewPro Grade S-35 NewPro Grade C-35	Grade S-35 is for cutting steel and C-35 is for cutting cast iron and non-ferrous materials.	Available as triangular and square inserts for mechanical tool holders and milling machine cutters. Rough-molded blanks also available.
Brazing Alloy	Nicrobraz 150	A high-temperature service brazing alloy that features high strength and oxidation resistance.	Is suited for use in the fabrication of such parts as turbine blades, rotor shafts, and highly stressed sheet-metal structures.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Cobalt Alloy	**Nilcor**	A high-cobalt-base bright metal with high corrosion resistance, good fatigue characteristics and a high-tensile yield strength.	Used in the production of torsion bands for precision balances.
Nylon Tubular Bar	**Nylatron GS**	This molybdenum-disulphide-filled nylon has a high modulus of elasticity, a high distortion temperature, and a low thermal expansion rate.	Used for close-tolerance fabrication of rollers, bearings, seals, washers, spacers, pipe unions, valve seats, gears, and insulators.
Metal Cleaner	**Oakite Composition No. 90**	This detergent cleaner is highly conductive, promotes good smut removal, gives controlled foaming, and has a long life in solution. Solutions have effective wetting and emulsifying properties for thorough removal of soils and smuts.	Used as a reverse-current cleaner for electro-cleaning of steel before plating.
Metal Cleaner	**Oakite Composition No. 190**	A reverse-current cleaner which provides good conductivity and surface activity and which removes fingerprints, light surface rust, and oxides resulting from spot- or seam welding.	For cleaning heavily smutted steel. May be used with or without precleaner.
Phosphatizing Compound	**Oakite CrysCoat**	This compound produces a fine-grained, dense, uniform coating which weighs between 150 and 300 milligrams per square foot.	Used at low temperatures in spray washing machines for coating ferrous metals.
Cleaning Material	**Oakite Drycid**	This material, supplied in powder form, has a mild aromatic odor and is non-fuming.	For removing corrosion materials from metal surfaces.
Cleaning Material	**Oakite Liqui-Det**	A concentrated liquid detergent which goes into solution quickly and penetrates and loosens most common soils in a very short time.	For general industrial use. It can be used repeatedly without rinsing and will not cause build-up of film or discoloration.
Stripper	**Octastrip 444**	This stripper is safe for use on all metals and is ideal for tank-immersion operations where fast production-line stripping is required.	For economical, cold-solvent stripping of epoxy finishes, epons, vinyls, urea-formaldehyde resins, modified alkyds, and other industrial finishes.
Die Sections	**O-Kni-Co**	These sections are available in six standard composite forms for use in die construction. The soft steel backing to which the hardened tool steel is bonded can be drilled quickly for dowel and screw holes.	Used for drawing and pinch-trim dies, heels, flanging, back-up plates, guides, and hold-down gibs.
Adhesive	**Plymaster V-2 and V-3**	These two solvent-free film adhesives for the flat surface bonding of all metals and plastics have either a porous fiber glass (V-2) or a high-strength porous paper (V-3) as their base.	Ideally suited for bonding nameplates, flat metal sheets, and flexible plastic films to rigid and semi-rigid metals and plastics.
Epoxy Resin Solder	**Poly Epoxyn Solder**	A solder made up of aluminum pigments combined with epoxy resins which is applied to precleaned and preheated metal areas. It can be sanded and painted after curing. Has a tensile strength of 1400 psi.	Used in many automobile applications where heat poses a problem. Can be used to repair holes, dents, tears, creases, and rusted-out areas.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Polyethylene Matting	**Poly-Met**	A matting material made of DuPont Alathon which has a high tear strength and is non-flammable.	May be used as floor runners, padding, splash boards, and protective covering.
Nylon Plates	**Polypenco Nylon 101 Polypenco Nylatron GS**	These plates, available in thicknesses of 1 1/4 to 1 1/2 inches, in widths of 10 inches, and in lengths up to 4 feet, exhibit high wear resistance and resilience, low surface friction, and non-galling characteristics.	Used for such applications as wear liners or pads, stripper knives or scraper blades, and equipment slides.
Protective Coating	**Protect-O-Metal No. 2**	A water-thinnable compound that is painted or sprayed on the part to be stress-relieved. May be used up to 1500 degrees F. for heating cycle of any length.	Prevents oxide-scale formation on ferrous parts during stress-relieving operations. May be removed with a rag or brush.
Adhesive	**Ray-Bond R-86001**	An adhesive for bonding cured natural or synthetic rubber to metal. It provides a bond so strong that the rubber will tear before it can be peeled from the metal.	Also used to bond metal, glass, ceramics, or wood to metal; as a protective coating; and as a sealing and casting compound.
Bearing Alloy	**Reticular Aluminum-Tin Alloy**	An aluminum-tin bearing alloy in which both the tin and the aluminum have continuous structures. The alloy combines strength with tin-availability.	For many bearing applications. It is supplied in the form of plain or steel-backed bearings.
Adhesive	**Rubbaweld**	This material provides a flexible shock-resistant bond that is unaffected by most oils, acids, or alkalis.	For bonding rubber, plastic, and fabric to metal.
Plastic Bar Stock	**Ryertex-Omicron PVC**	A rigid polyvinyl-chloride industrial plastic for automatic screw machine production of corrosion-resisting parts. Parts may be easily machined.	For sealers, valve components, and fasteners which are used in applications where a non-corrosive material is required.
Adhesive Films	**Scotch-Weld Brand Bonding Films AF-200 and AF-201**	These two composite film adhesives for bonding honeycomb sandwich construction have a high-strength, elastomeric adhesive film on one surface and a self-filleting adhesive on the other.	For the fabrication of bonded primary airframes in aircraft and missile honeycomb sandwich structures.
Die Steel	**Select B FM Oversize Ground**	An air-hardening steel containing 5 per cent chromium with added sulphide particles which contribute to machining ease. Also contains wear-resistant carbide particles.	Being oversize by 0.001 to 0.012 inch, it facilitates grinding to nominal dimensions after heat-treatment.
Resin Coating	**Sonite SC-2**	A blue epoxy resin compound formulated for use in hand lamination systems where surface hardness and resistance to abrasion are desired. It has sufficient thixotropy for application as a heavy brush coat (without sagging) on a vertical surface.	It may be used plain as a surface coat for tanks and barrels or as a bonding agent with good adhesion, chemical resistance, and stability.
Pre-Plated Metal	**Specification Plate on ChromSteel**	A pre-plated metal that makes possible heavy-chromed finishes of uniform quality. The metal may be deep-drawn or stretched without lessening its resistance to corrosion.	Applications include automotive trim and accessories, general fixtures, home appliances and parts, interior trim, and electrical uses.
Coating Material	**Spra-Carb**	This coating of tungsten-carbide particles bonded with nickel, chromium, and boron can be machined with a good hard grade of tungsten carbide, or may be ground with a green silicon or diamond wheel.	For hard-surfacing metal surfaces with a tough, strong, and highly wear-resistant surface of from 0.010 to 0.062 inch in thickness.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Copper Bearing Steel	**Stressproof (with Copper)**	These steel bars, because of the added copper, are more wear-resistant than the plain product. They have a tensile strength of approximately 100,000 psi.	For those applications where improved machinability, wear-resistance, etc., make its use more desirable than the company's plain bar.
Wire	**Techalloy Wire**	This wire, available in flat and shaped cross-sections, has been annealed and cleaned and then rolled with extreme care on tungsten-carbide rolls to provide polished surfaces which are corrosion-resistant.	For uses where Monel, nickel, Inconel, Inconel X, Incoloy, nickel-clad copper, and other similar wire materials are required.
Aluminum Casting Alloy	**TENS-50**	Average sand-cast sections (1/8 to 3/4 inch thick) have an ultimate tensile strength of 36,000 psi. When permanent molded it has a tensile strength of 50,000 psi and a tensile yield strength of 44,000 psi.	Can be sand cast or permanent molded to give strengths comparable to aluminum forgings.
Wiping Cloth	**Tex-Pro Kwik Wipe**	This non-woven, lintless cotton wiping cloth will absorb nine to ten times its weight in water.	It has been used successfully with water, oil, gasoline, kerosene, and mineral spirits.
Die Lubricant	**Thermex C-35**	This die lubricant was developed for heavy-duty hammer forging operations.	Use of the compound results in good metal flow in the die, less sticking of forgings, and relatively clean die surfaces.
Seals	**TSI Machine Seals**	These O- and V-ring seals have square, round, or oval cross-sections and can be subjected to pressures up to 30,000 psi at temperatures of from minus 200 degrees F. to plus 425 degrees F. They are made of Teflon.	They are used in the chemical, aircraft, and electronics industries, where corrosives such as fuming nitric acid may be used.
Stainless-Steel Shafting	**Type A8 Precision Ground Shafting**	This centerless-ground shafting is finished to a 10-micro-inch roughness value and has a tolerance of plus 0.0000 inch and minus 0.0002 inch.	Available in a range of sizes from 1/32 to 1/2 inch. It can be used for instruments and precision parts.
Cast Steel	**Utaloy Die Steel**	This gall-resistant, cast die steel, which is capable of heat-treatment, has a consistent critical hardness of 60 to 62 Rockwell C.	Developed to replace more expensive forged steels for punch and die applications.
Vibration Damper	**Vibracork**	This material, available in two variations, one for loads from 1500 to 4500 psf and the other from 4500 to 8500 psf, resists oil, water, and acids and may be used continuously at a temperature not exceeding 180 degrees F.	For controlling vibration, shock, and noise on machinery.
Nickel-Chromium Alloy	**W-545**	A vacuum-melted alloy that retains its strength at temperatures up to 1350 degrees F. It is non-magnetic and has a high yield strength.	High-temperature uses include turbine wheels, couplings, shafts, etc., in missiles and turbines. Low-temperature applications include retaining rings and wedges for electrical apparatus.
Lubricant	**Warco Coupling Lubricant**	A lubricant for threaded assemblies where high-pressure shock loading and high temperatures prevail. It is non-melting and has high adhesive powers.	It is recommended for drill collars, tool joints, drill tubing, drill couplings, and tool-bit threads.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Parting Compound	White Stop-Off	This material, which acts as a parting compound, may be applied by brushing, dipping, or spraying. The residue which remains may be removed by air-blasting or brushing.	To prevent the brazing of not-to-be-brazed mating surfaces during furnace brazing operations.
Fire Extinguisher	X-8	A dry granular material which, when placed on metallic fires, extinguishes them.	In addition to its use as a fire extinguisher it is used as a packing material to prevent fires, and as an additive to scrap piles for the prevention of spontaneous combustion.

Names and Addresses of Manufacturers of Products Listed

Acoustica Ultrasonic Cleaner No. 715—Acoustica Associates, Inc., Dept. No. 715, 26 Windsor Ave., Mineola, N. Y.

Alcoa Alloy 5456—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

Alcoa Alloy X385—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

Alcoa Alloy X5454—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh, 19, Pa.

Alcoa Aluminum Stair Tread—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

Alfenol—Hamilton Watch Co., Metals Processing Section, Lancaster, Pa.

Almanite—Meehanite Metal Corpn., 714 North Ave., New Rochelle, N. Y.

Ampco-Braz Flux No. 2—Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, Wis.

Ampco-Trode 160—Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, Wis.

Anchor No. 302—Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn 22, N. Y.

APM Alloys M257, M430, and M470—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

ASC Micro-Shim Stock—American Silver Co., 36-07 Prince St., Flushing 54, N. Y.

Beechem Layout Fluid—Beechem Laboratories, 1102 W. State St., St. Johns, Mich.

Boltaflex 500—General Tire & Rubber Co, Akron, Ohio.

Bondmaster G458—Rubber & Asbestos Corpn., Dept. P, 225 Belleville Ave., Bloomfield, N. J.

BR-4—Latrobe Steel Co., Latrobe, Pa.

Brilok Nylon Stop-Nut—Byrd Plastics, Inc., 2953 W. 12th St., Erie, Pa.

Color-Plast—General Gasket, Inc., Middletown, Conn.

Cramolin—Caig Laboratories, 46 Stanwood Road, New Hyde Park, N. Y.

Crown Toolmaker's Ink—Crown Industrial Products Co., Dept. MYN, 713 Amsterdam St., Woodstock, Ill.

Crucible B-120VCA, C-105VA, C-115AMoV—Titanium Division, Crucible Steel Company of America, Midland, Pa.

Custom Lube 101L—Custom Lubricant Co., 743 Dwight Way, Berkeley 10, Calif.

D.E.R. 332, 331, 334—Dow Chemical Co., Midland, Mich.

Devcon WR—Devcon Corpn., Danvers, Mass.

Eastman 910 Adhesive—Eastman Chemical Products Inc., Kingsport, Tenn.

EC-1368—Adhesives, Coatings & Sealers Division, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich.

Eccobild 121, 127, 420, 470, 430, 490—Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

Enbond Z and Enbond BR—Enthone, Inc., 442 Elm St., New Haven, Conn.

Epofil B-1—Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif.

Esbec No. 234—Esbec Barrel Finishing Corpn., 18 Beech St., Byram, Conn.

Fast-Line—Optical Gaging Products, Inc., Rochester, N. Y.

Foamsil—Pittsburgh Corning Corpn., One Gateway Center, Pittsburgh 22, Pa.

Froil—Octagon Process, Inc., 33 Bank St., Staten Island 1, N. Y.

Galvinoleum—Rust-Oleum Corpn., 2799 Oakton St., Evanston, Ill.

General Electric Fluid 81743—Silicone Products Department, General Electric Co., Waterford, N. Y.

Grades ETR Grease B and ETR Grease D—Shell Oil Co., 50 W. 50th St., New York 20, N. Y.

Graphilm Industrial Lubricant No. 702—Charles Pettinos, Inc., 1 E. 42nd St., New York 17, N. Y.

Gulfcut Heavy-Duty Soluble Oil—Gulf Oil Corpn., Gulf Bldg., Pittsburgh, Pa.

Gulton Ceramic Coating Process—Gulton Industries, Inc., 212 Durham Ave., Metuchen, N. J.

Hardsteel HD-27M—Black Drill Co., 1400 E. 222nd St., Cleveland 17, Ohio

Haynes Metal Ceramic LT-1, LT-1B, Lt-2—Haynes Stellite Co., Kokomo, Ind.

Hedervan—Latrobe Steel Co., Latrobe, Pa.

HY-80 and T-1—United States Steel Corpn., Pittsburgh 30, Pa.

Names and Addresses of Manufacturers of Products Listed

J-1300—Metallurgical Products Department, General Electric Co., 11177 Eight Mile Road, Detroit 32, Mich.

Johnson's Wax-Plate No. 6143—S. C. Johnson & Son, Inc., Racine, Wis.

Kano Kroil—Kano Laboratories, 1000 S. Thompson Lane, Nashville 11, Tenn.

Kenface—Kennametal Inc., Latrobe, Pa.

Kenplate—Kennametal Inc., Latrobe, Pa.

Keystone 122C-5X—Keystone Lubricating Co., 3100 N. 21st St., Philadelphia, Pa.

Krylon—Krylon, Inc., 18 W. Airy St., Norristown, Pa.

Lankote 200-H—J. Landau Co., Carlstadt, N. J.

Lexan—Chemical Development Department, General Electric Co., Pittsfield, Mass.

Lorco 3X—Lord Chemical Corpn., 2068 S. Queen St., York, Pa.

Lorco Lustre-All—Lord Chemical Corpn., 2068 S. Queen St., York, Pa.

Lukens Nine Nickel—Lukens Steel Co., Coatesville, Pa.

M & T Armorhide—Metal & Thermit Corpn., Rahway, N. J.

Maraset Resin No. 639—Marblette Corpn., 37-31 Thirtieth St., Long Island City 1, N. Y.

Metalset A4—Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J.

Metex—Adhesive Products Corpn., 1660 Boone Ave., New York 60, N. Y.

Milburn's Ply No. 9 Liquid—Milburn Co., 3246 E. Woodbridge, Detroit 7, Mich.

Milford Precision Ground Flat Stock—Henry G. Thompson & Son Co., New Haven, Conn.

MST 2.5Al-16V and MST-821—Mallory-Sharon Titanium Corpn., Niles, Ohio

Nero-Zinc—Wagner Brothers Inc., 400 Midland, Detroit, Mich.

NewPro Grades S-35 and C-35—Newcomer Products, Inc., Latrobe, Pa.

Nicrobraz 150—Stainless Processing Division, Wall Colmonoy Corpn., 19345 John R St., Detroit 3, Mich.

Nilcor—Athenia Steel Co., National-Standard Co., Clifton, N. J.

Nylatron GS—Polymer Corporation of Pennsylvania, 2140 Fairmont Ave., Reading, Pa.

Oakite Composition No. 90—Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

Oakite Composition No. 190—Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

Oakite CrysCoat—Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

Oakite Drycid—Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

Oakite Liqui-Det—Oakite Products, Inc., 126 Rector St., New York 6, N.Y.

Octastrip 444—Octagon Process, Inc., 30 Bank St., Staten Island 1, N. Y.

O-Kni-Co—Ohio Knife Co., Dept. EE-77, Cincinnati 23, Ohio

Plymaster V-2 and V-3—Rubber & Asbestos Corpn., Dept. P, 225 Belleville Ave., Bloomfield, N. J.

Poly Epoxyn Solder—Co-Polymer Chemicals, Inc., 12350 Merriman Road, Livonia, Mich.

Poly-Met—Clopay Corpn., Industrial Products Division, Clopay Square, Cincinati 14, Ohio

Polypenco Nylon 101 and Polypenco Nylatron GS—Polymer Corpn. of Pennsylvania, 2140 Fairmont Ave., Reading, Pa.

Protect-O-Metal No. 2—G. W. Smith & Sons, Inc., 1700 Spaulding Road, Dayton 3, Ohio

Ray-Bond R-86001—Raybestos-Manhattan, Inc., Bridgeport 2, Conn.

Reticular Aluminum-Tin Alloy—Tin Research Institute, Inc., 492 W. 6th Ave., Columbus 1, Ohio.

Rubbaweld—Rubba, Inc., 1015 E. 173rd St., New York 60, N. Y.

Ryertex-Omicron PVC—Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.

Scotch-Weld Brand Bonding Films AF-200 and AF-201—Adhesives, Coatings & Sealers Division, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich.

Select B FM Oversize Ground—Special Products Division, Latrobe Steel Co., Latrobe, Pa.

Sonite SC-2—Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J.

Specification Plate on ChromSteel—Apollo Metal Works, Dept. MYN, 6650 S. Oak Park Ave., Chicago 38, Ill.

Spra-Carb—Walmet Corpn., 29900 John R, Madison Heights, Detroit, Mich.

Stressproof (with copper)—LaSalle Steel Co., 1420 150th St., Hammond, Ind.

Techalloy Wire—Techalloy Co. Inc., Rahns, Pa.

TENS-50—Navan Products, Inc., 1318 Second St., Santa Monica, Calif.

Tex-Pro Kwik Wipe—Textile Products 181-189 Chestnut St., Newark 1, N. J.

Thermex C-35—D. A. Stuart Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

TSI Machine Seals—Tri-Point Plastics Inc., 175 I. U. Willets Road, Albertson, L. I., N. Y.

Type A8 Precision Ground Shafting—PIC Design Corpn., 477 Atlantic Ave., East Rockaway, N. Y.

Utaloy Die Steel—American Foundry & Machine Division, Eimco Corpn., P. O. Box 300, Salt Lake City, Utah.

Vibracork—Korfund Co., Inc., 48-39M 32nd Place, Long Island City 1, N. Y.

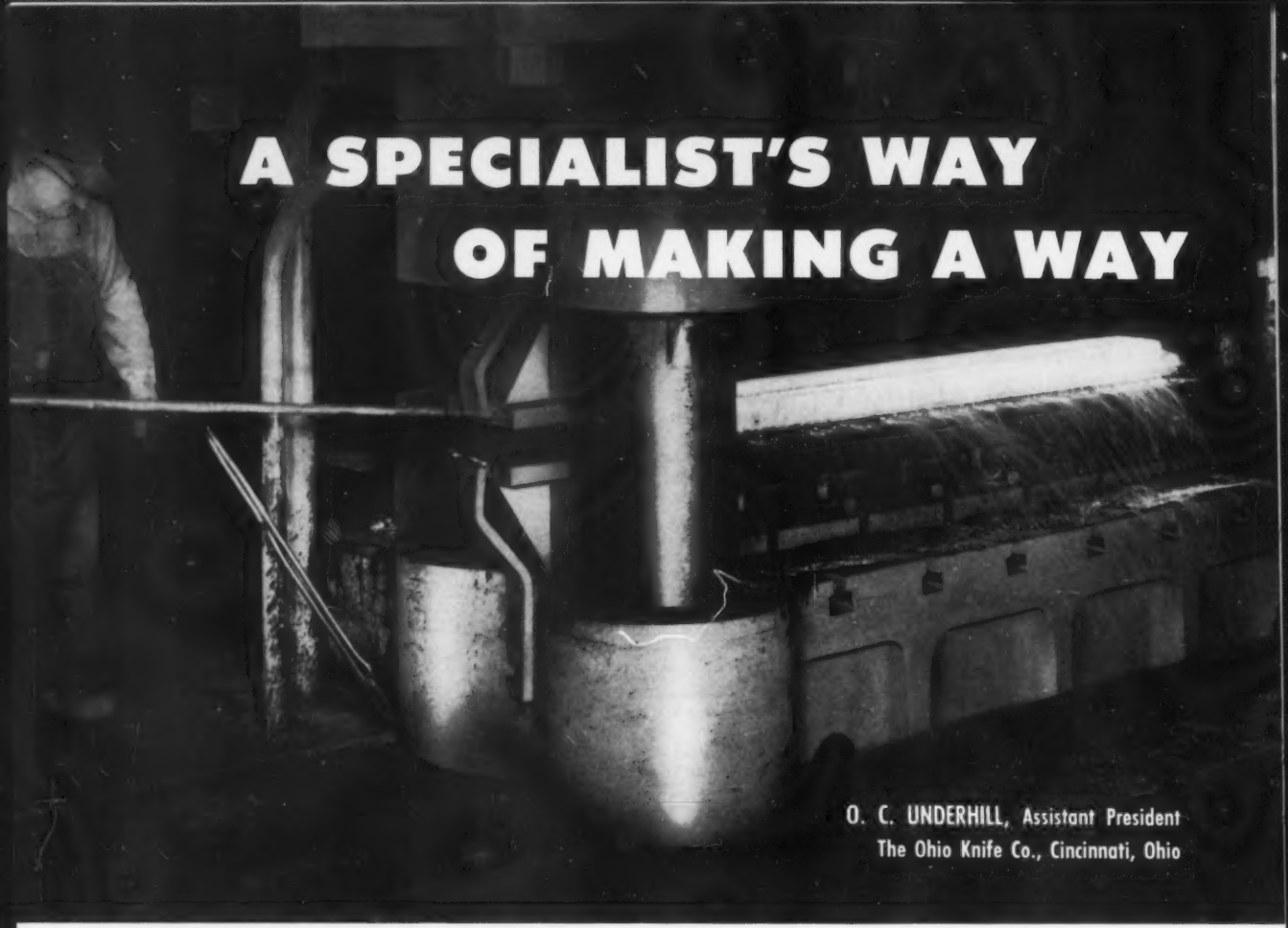
W-545—Westinghouse Electric Corpn., P. O. Box 2099, Pittsburgh 30, Pa.

Warco Coupling Lubricant—Warren Refining & Chemical Co., 5151 Denison, Cleveland, Ohio

White Stop-Off—Stainless Processing Division, Wall Colmonoy Corpn., 19345 John R St., Detroit 3, Mich.

X-8—Mercantile Metals, Inc., P. O. Box 478, Carnegie, Pa.

A SPECIALIST'S WAY OF MAKING A WAY



O. C. UNDERHILL, Assistant President
The Ohio Knife Co., Cincinnati, Ohio

Composite way construction of two different materials spells accuracy for sliding members in many machine tools.

THE FLAT BEARINGS, or ways, of a machine tool are among its most critical elements. Frequently, the machine tool builder assigns their construction to a specialist like the Ohio Knife Co. Described here is the exacting procedure followed by this Cincinnati firm in making a way.

Ohio Knife furnishes ways which are a composite of two materials pressure-welded together: The actual bearing surface is a cladding of hardened ball-bearing tool steel (SAE 52100), and the bulk of the cross-section is a backing of soft. mild steel. The way section in Fig. 1 illustrates this construction. This combination of materials is used for all styles of ways—vee, square, or other shape.

Incoming bars or plates of both steels are flame-cut or sawed to a predetermined length. (During the processing, the composite is reduced in cross-section and elongated, as will be explained.) Next, the tool steel and backing are heated simultaneously to 2300 degrees F. in separate furnaces. The backing is removed from its furnace first, and a cleaning agent and then a welding compound are applied to the surface to be cladded. The tool-steel plate is next removed from its furnace, as is being done in Fig. 2, and placed on the backing.

When both are aligned, a protective powder is sprinkled over them, and they are returned as a unit to one of the furnaces for several minutes. The work is then transferred to a 2500-ton press, seen in the heading illustration, and the two steels welded solidly together to form an inseparable bond. Should the design of the way require more than one surface to be cladded, the steps thus far described are then repeated for each new cladding until the build-up has been completed.

At this point, the way is considerably shorter in length and heavier in cross-section than is required in the finished product. It is now prepared for hot rolling, which process serves to refine the grain structure while reducing its mass and elon-

gating it. An added advantage of this method is that it is possible to build ways for even a relatively long machine tool bed, since the material is initially short enough to be accommodated in the furnaces and the welding press. What is more, the relatively small amount of tool steel used, in comparison to the cross-section, offsets the cost of forging and rolling.

Before being rolled, the work again enters a furnace, where it is held at high heat, 2300 degrees F., to give the tool steel the same plasticity as the backing. Then the way is brought to the rolling mill.

This equipment is a single-stand reversible mill. A view from the entry end appears in Fig. 3. In going through the mill, the work passes between two pairs of rolls—one horizontal and one vertical—which reduce its cross-section. The desired reduction is obtained in a series of passes back and forth, the spacing of each roll pair being shortened before each pass.

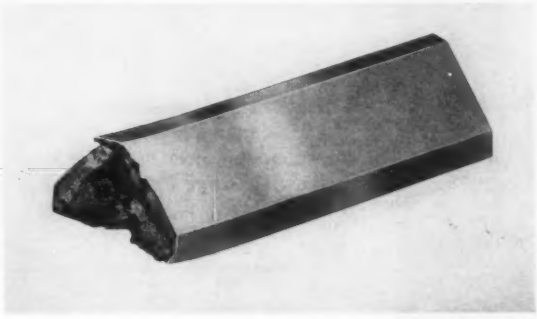


Fig. 1. (Above) The tool-steel bearing surface and the mild-steel backing of this V-way can be seen in the broken end.

Allowed to cool in air, the composite is annealed at 1600 degrees F. for four hours in one furnace, then at 1425 degrees F. for a similar period in a second furnace. The annealing removes the bulk of the hardness and strain developed during the cladding and rolling steps.

Next, about 3 inches is trimmed from each end of the way. A multiple-roll straightening operation follows. As the work passes back and forth between the rolls, the cold-working flexes the material and stress-relieves it further.

Sides and edges of the way are now machined oversize. In addition, any required relief area, tongue, or shoulder for a keeper strip is roughed out, either by planing or milling; and any holes needed through the tool-steel area are now drilled.

For the subsequent heat-treating, Ohio Knife immerses the ways in a molten salt bath, followed by a brine quench. The way shown in Fig. 4 is about to be lowered into the bath. The liquid salt is circulated like boiling water around the work, which reaches a temperature of 1450 degrees F.

After the quench, the way is tempered in a gas furnace at 350 degrees F. for four hours. Hardness of the clad surface is now 64 to 66 Rockwell C. This degree of hardness, in combination with the high quality of the tool steel used, maintains the precision of the machine tool for many years. The backing, because of its low-carbon content, is unaffected by the heat-treatment, and remains soft.

At this time, only 0.020 inch of excess metal remains on the way surfaces, so an important

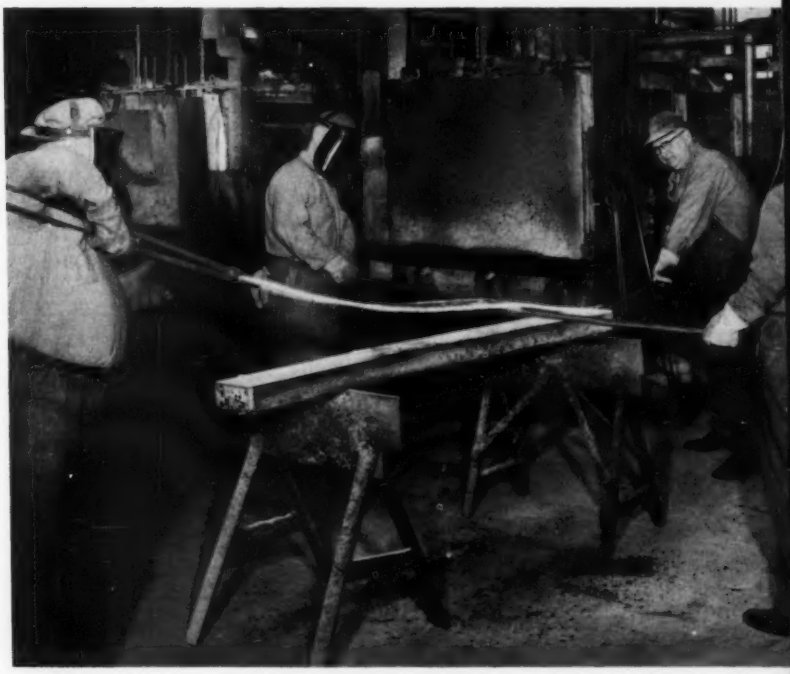


Fig. 2. (Right) The tool-steel strip is removed from its furnace and aligned with the backing, which previously has been removed from its furnace.

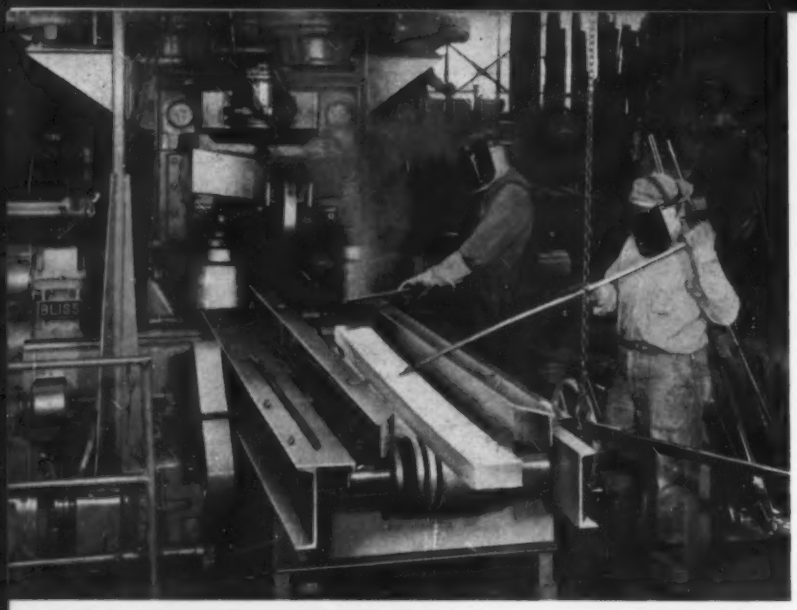


Fig. 3. The composite, which is welded together under heat and pressure, enters the rolling mill, where it will be refined, reduced in cross-section, and elongated.

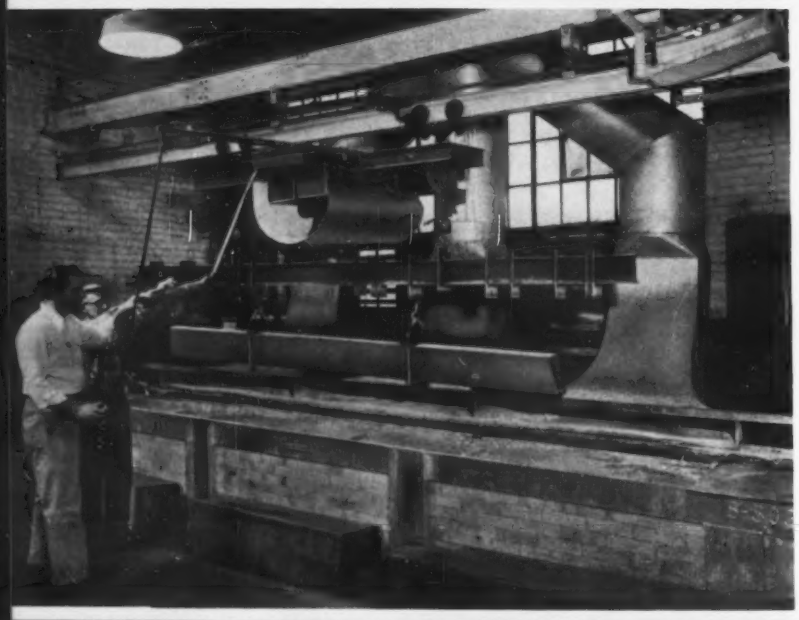


Fig. 4. The composite is about to be lowered into the molten salt bath for the first stage in its heat-treatment.



Fig. 5. Any distortion developed in heat-treating is removed by this straightening operation prior to the finish-machining.



Fig. 6. This V-way is supported on a magnetic chuck for the grinding of its tool-steel bearing surfaces.

straightening operation is in order. A number of crews perform this work, which is largely an art. In Fig. 5, a crew straightens a way on a 75-ton press.

Backing surfaces can now be finished by milling or planing. Finish cuts are also taken on tongues, shoulders, and keyways. Holes are drilled to size.

Face grinding the composite is the next step, as in Fig. 6. Work is roughed to within 0.006 inch of size, then finished on large surface grinders, frequently to tolerances of plus or minus 0.0002 inch. Specially built magnetic V-blocks, fixtures, and sub-plates are used for supporting the work. Trunnions at each end of the fixtures permit them to swivel to present different surfaces of the way to grinding wheel. (The company makes all its own magnetic blocks. These are ground to a tolerance of plus or minus 0.00005 inch in order to be matched in a set.) Processing is now completed, and after careful inspection, the way is ready for shipment.



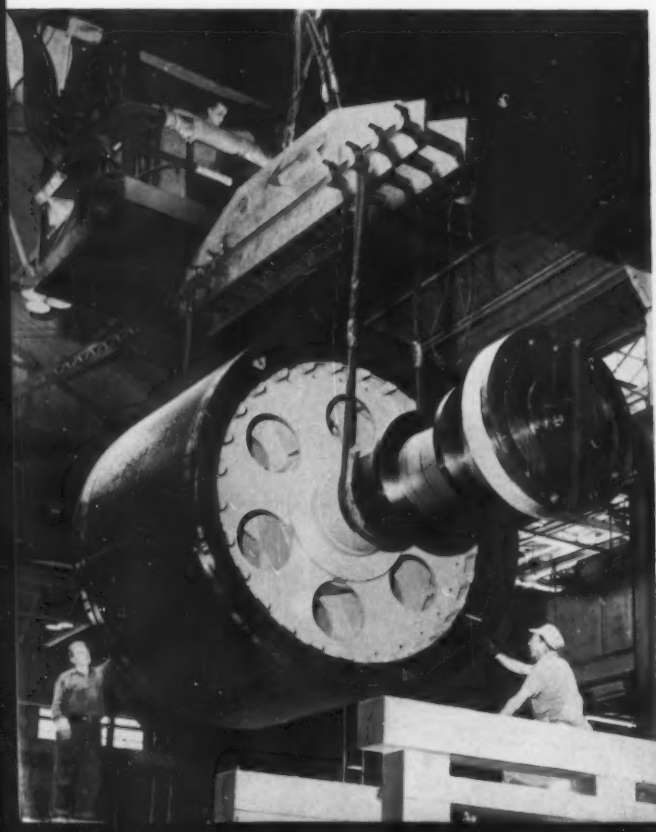
Stainless-steel segments of a nuclear fuel element are seen being automatically welded at the recently opened General Engineering Laboratories of Alco Products, Inc., Schenectady, N. Y. Among current research projects at these facilities is a study of new ways for welding stainless-steel parts of heat exchangers. Also, an inexpensive method of applying stainless-steel cladding to carbon steels for use in nuclear and chemical work has been developed.

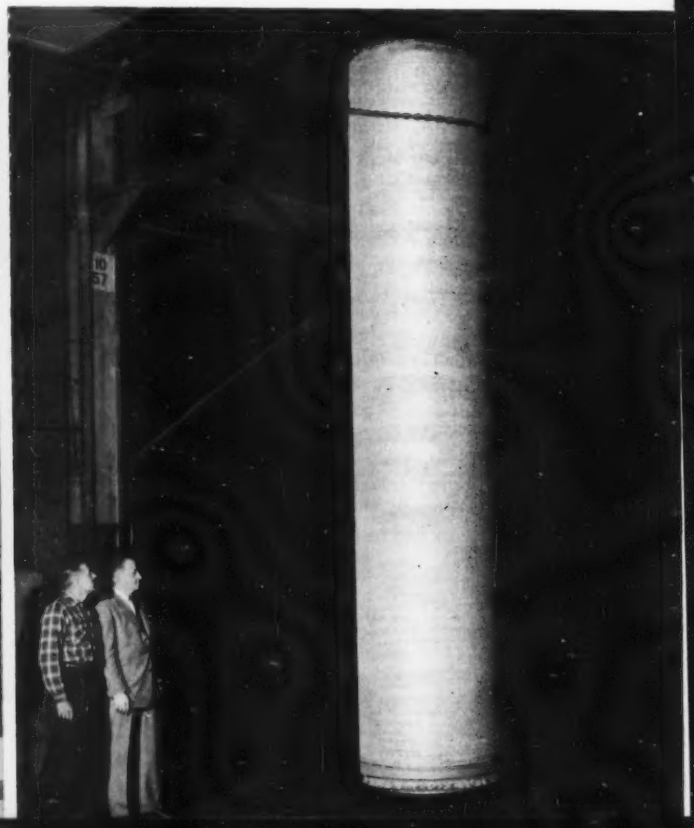


Camera highlights of some interesting operations performed in various metalworking plants throughout the nation by unique applications of machines and tools

BIG BOY—This 98,700-pound rotor being readied for shipment at Schenectady, N. Y., is part of $5,500,000 worth of electrical apparatus International General Electric is providing for Cia. Fundidora Iron & Steel of Monterey, Mexico. The electrical system will go into the first automatic card-programmed mill operation in the Mexican steel industry. The rotor, for a rolling-mill motor, is being lowered into place on a flatcar.

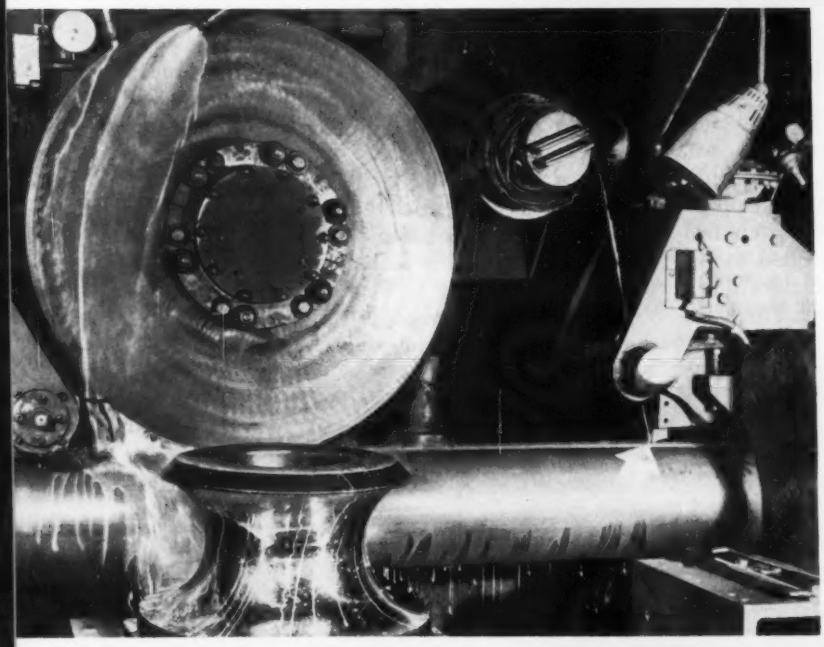
RECORD BREAKER—Aluminum Company of America, Lafayette, Ind., cast this 24,000-pound ingot for the Thiokol Chemical Corporation, a manufacturer of rocket-engine propellants. Believed to be the largest of its type, the huge cylinder is cast of alloy 2014, is 205 inches long and 38 1/2 inches in diameter. It will be fabricated into a part that could help improve power and performance of missiles and rockets soon to be launched.





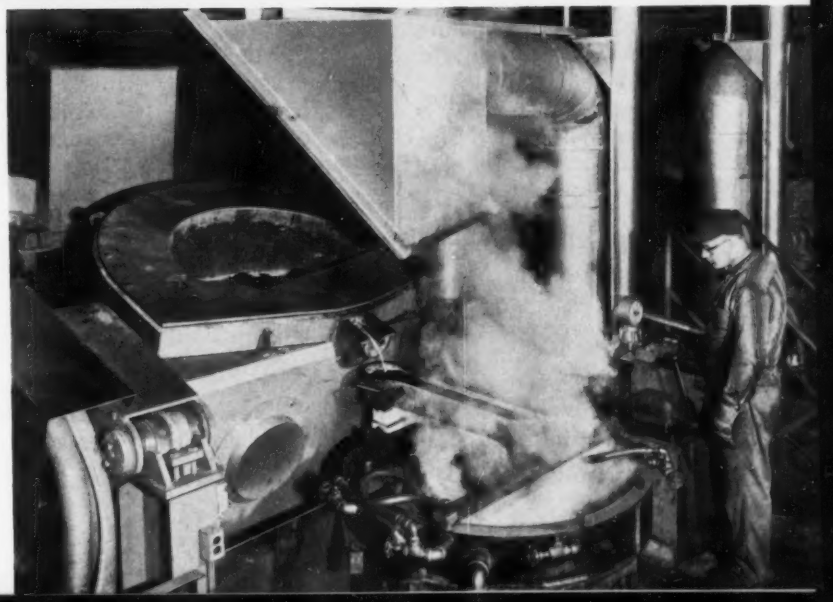
INTERRUPTED CUT—A segmented master gear for a large, hospital X-ray machine receives an interrupted facing cut at the Ohio Gear Co., Cleveland. Requiring an accuracy of plus 0.001 inch, minus 0.000 inch, the 25 1/4-inch diameter iron casting receives ten separate machining operations in a single chucking. The gear is held in a counterbalanced fixture on a Warner & Swasey saddle type turret lathe.

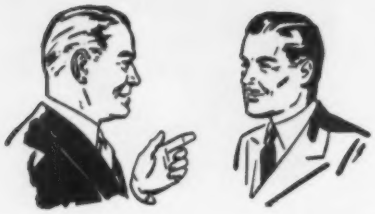




SCRAP RIBBON—At the Beall Pipe & Tank Corporation, Portland, Ore., a Carmet CA-610, indexable insert tool removes excess metal from the bead of welded pipe as it leaves a continuous type mill. The scrap ribbon is automatically wound on a spool as the pipe is formed at about 55 feet per minute. Tool life amounts to 10,000 feet of pipe per cutting edge.

CONTINUOUS CASTING—At the American Brass Co., Ansonia, Conn., copper-base alloy billets and rolling-mill slabs in lengths up to 12 feet are cast in a continuous process. Molten metal flows from electric furnaces to Lobeck casting machines. The molds are water-jacketed and bottomless. As the solidified metal leaves the bottom of the molds, the tops are continuously filled with molten metal. The predominantly longitudinal solidification prevents piping and internal stresses, it is claimed.





Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

Is Sales Management Getting Too Impersonal?

"MY TOUGHEST JOB is to bridge the gap between the sales engineer in the field and myself. Although it's a lot easier to travel and communicate than ever before, we are more separated in our thinking and interests than we used to be. Sales management as well as selling has gotten terribly mechanized."

This grievance, lately expressed by the sales manager of a growing equipment concern, touches on a sweeping trend in the relationship between manager and sales engineer that all of us should heed. Mechanized, impersonal control is bound to be destructive when applied to individuals—especially those at work on sales.

There are basic sources of this trend. The sales force grows in size and spreads out to scattered locations so as to be near customers' plants. At the same time, the average sales engineer's attention narrows, through specialization, into fewer channels of work. So we resort more and more to ticker-tape control. Systems are set up that classify, package, and decorate ideas and then load them on the conveyor belt that leads to each sales engineer. Here they are quick to pile up on his desk or in his files awaiting odd moments that never arrive. "Parkinson's Law," a current satire on business, points out that work is stretched out to absorb available time, and subordinates are multiplied at a fixed rate regardless of the work to be done. How true!

The sales manager is not the only one in the clutch of conformity. The craze for training managers according to a pattern is moving ahead so fast that we find a hierarchy of those schooled in decision-making and skills of command who have never had the opportunity to gather wisdom by doing. Learning the "what-to-do" formula and how to apply it diplomatically ranks high at present as a feature of executive development.

In the sales sphere, with decreased occasion for man-to-man contact between manager and sales engineer, we rely too much on classifying and dispensing ideas through mass media. We reiterate the importance of meeting or exceeding the bogey of a fixed sales level rather than helping the individual sales engineer to develop originality and proficiency in the many ways of reaching it. To renew the personal relationship, we resort to group meetings and "shirt-sleeve" sessions. These attempts to increase enthusiasm sometimes border on the burlesque. We rush out to the salesman to "sit down and talk things over." Too often this "talk" proves to be a race regulated by a stop watch.

What will bring manager and sales engineer closer together, diminish "system control," and augment individuality and ingenuity? The following suggestions may be fitting:

Of initial importance is the readjustment of the objectives of many sales engineers. Sales-bogey figures are only symbols of quantity related to time. Nothing should take precedence over ideas—fresh conceptions—of how our equipment and services can lead the customer to profit. These ideas can be presented more convincingly.

Get rid of the concept that there is but one best way to make a sale, and that this alone will succeed. Technology is far too complex to be satisfied with pat answers, for answers only lead to more questions.

Examine regulations and systems critically, but don't confuse these with policies and plans. We venture you will find rules and regulations that crimp individual imagination and responsibility. Don't imitate the red tape so often found in government bureaus.

How about compensation? Incentives for increasing dollar sales abound, but what are your rewards for fresh ideas whose value may even exceed that of actual orders? Suggestion systems have worked out well in the fields of technology —how about in sales?

No, the advance of industry does not permit the former close personal contact between manager and men. It does provide a greater opportunity for assisting in the growth of sales engineers, if we lift our sights, lop off system control, and set up incentives for original thinking.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

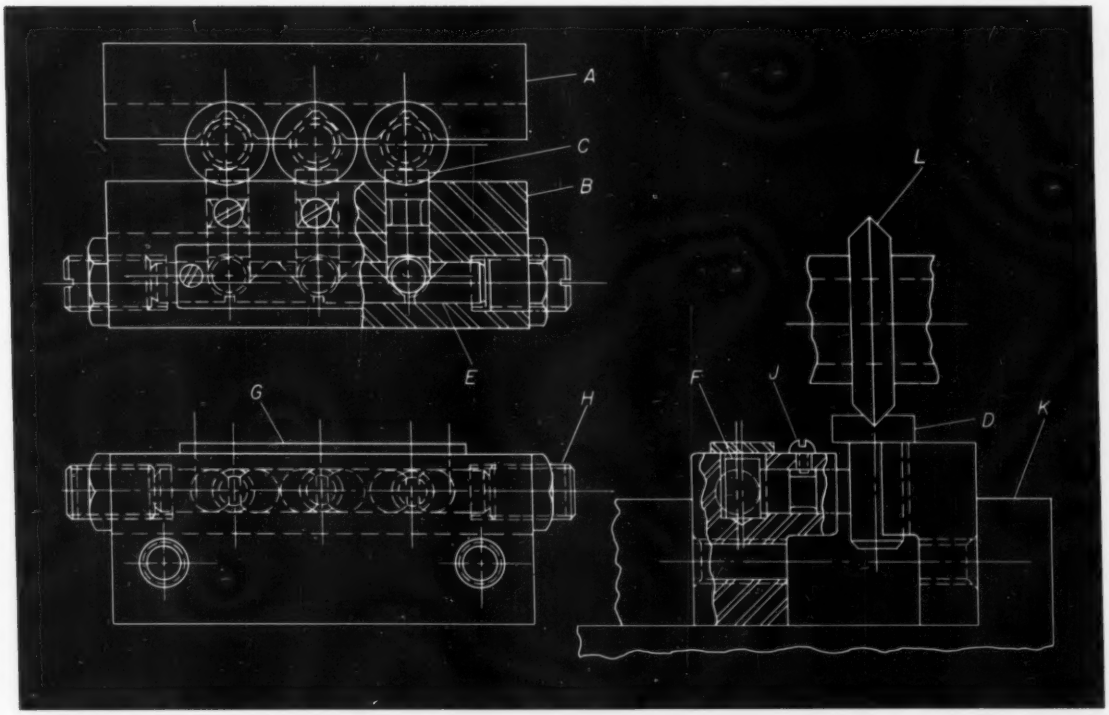
Vise Jaws Self-Adjusting for Multiple Parts

C. ANDREWS, Dayton, Ohio

Occasionally, the milling of three or more parts at one time is advantageous. Self-adjusting vise jaws for simultaneously holding three cylindrical work-pieces of slightly different diameters are here illustrated. These special jaws are easily attached to a machinist's vise by cap-screws.

Fixed jaw *A*, shaped as shown, has three vertical, 90-degree V-grooves. Movable jaw *B* is equipped with three horizontal plungers *C* situated opposite the V-grooves, and on closing the vise each work-piece *D* is clamped in one of the V-grooves by a plunger. Plungers *C* move in and out to take care of variation in part diameter. This small movement is compensated automatically by a lateral adjustment of the angle-faced plungers *E*. Pins *F* serve to transmit motion from plunger to plunger. These pins are mounted in clearance holes to permit the movement of the plungers. Plate *G* is removable to permit lubrication of the moving parts.

When the vise jaws are assembled for use, pins *F*, should be in the center of their clearance holes. This is accomplished by adjusting the two large slotted set-screws *H* and moving plungers *C* in or out as necessary. Retaining screws *J* should be replaced temporarily by longer screws which



Designed for holding multiple parts, these vise jaws automatically adjust to slight size variations in the work-pieces.

can be used to clamp plungers *C* in place after they are properly adjusted. The clamping ends of the three plungers should then be ground true and parallel to the face of the jaws in one setup. After inserting retaining screws *J*, the jaws are attached to a machinist's vise *K* for milling work-pieces with cutter *L*. Although these vise jaws were designed to hold three parts, redesign for additional plungers and pins will increase the part-holding capacity.

Device for Levelling Bored Parts

W. M. Halliday, Southport, England

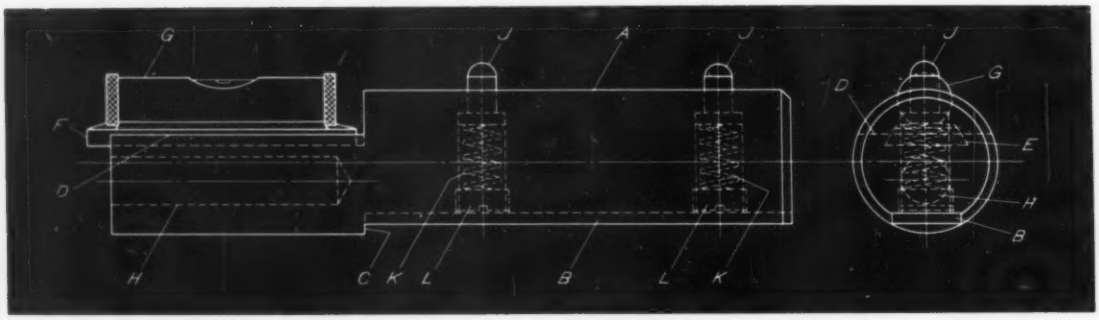


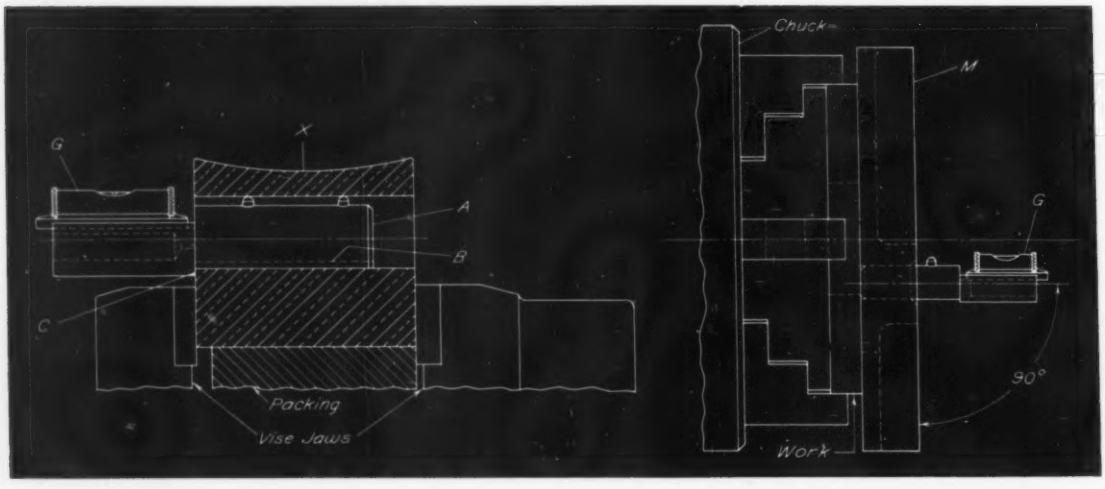
Fig. 1. Details of plug mounting for spirit level that permits easy setup of parts from bored holes. Spring-loaded plungers (J) keep device aligned with hole.

When using a bored hole as a datum, the simple levelling arrangement here illustrated may prove effective in the setting up of rough or irregular work-pieces for machining. The device employs a spirit level and is applied either directly to the part or indirectly through the use of an auxiliary mounting.

The body of the device is illustrated at *A* in Fig. 1. It is a cylindrical rod of casehardened steel that has been ground to have an outside diameter of about 1/8 inch less than the smallest hole in the work being used as a datum. The length of the rod is approximately one and one-half that of the hole. A rectangular slot *B* is milled along and parallel to one side of the rod, extending about two-thirds the length of the part. A square step *C* is formed at the end of the slot.

Flat *D* is machined into the other end of the rod and diametrically opposite the slot. This flat extends almost to step *C*, which is located on the

Fig. 2. Part held in machine vise is tested for levelness. Special bar (M) adapts the device for setting up thin, flat work in a lathe chuck.



underside. A dovetail groove *E* is milled centrally along the width of the flat. The two long sides of the base *F* of a spirit level *G* are filed at an angle to be a light press-fit into the dovetail groove. To reduce the weight of the device, a large-diameter, blind hole *H* is drilled into this end of the rod.

Two hardened steel plungers *J* slide freely within holes bored diametrically through the right end of the rod. These plungers are situated a considerable distance apart and are perpendicular to the base of the slot. The end of each plunger projects about 1/4 inch out of the rod and is rounded hemispherically. A light coil spring *K* bears against the head of each plunger to force it outward. Each spring, in turn, acts against a threaded plug L that is screwed into the lower end of the guide hole.

The way the levelling device is employed to align a work-piece *X* that is gripped in a vise is shown at the left in Fig. 2. The part of the rod extending beyond the spirit level is simply inserted into the hole in the casting before the latter is gripped in the vise of the machine. Rod *A* is placed so that slot *B* is at the lower side of the hole and step *C* abuts the front end face as shown. The edges of the slot bear evenly against the side of the hole to prevent the rod from turning easily. When the device is inserted into the casting, the spring pressure on the depressed plungers serves to hold the rod firmly in alignment with the center axis of the hole.

The casting is then clamped in the vise on the unmachined surfaces and adjusted until the spirit level indicates a truly horizontal setting. Care should be taken to avoid closing the vise jaws on a very uneven surface or on high spots.

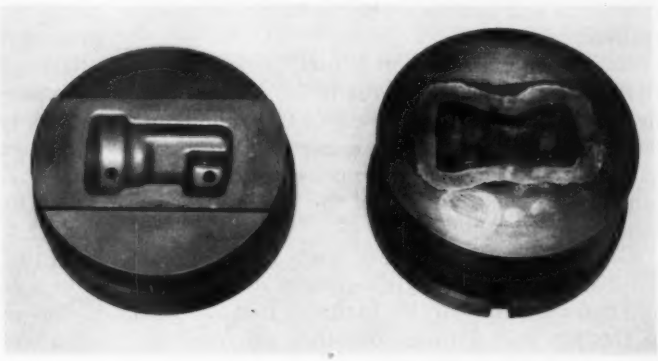
Another application of the levelling device is depicted at the right in Fig. 2. In this case, it is employed to check the setup of a large-diameter, rough, ring casting held in a lathe chuck for boring and facing. It will be noted that the illustrated casting is narrower than the widths of steps on the chuck jaws. The work-piece, therefore, cannot be positioned against the jaws for facing.

Ordinarily, four blocks of identical height would be inserted behind the work-piece—one at each jaw. Blocks of this kind are rarely at hand when required and are difficult to manipulate and retain in position behind the work-piece until a tight grip is obtained on the casting.

One adaptation of this device that avoids these setup difficulties is comprised of the complete levelling gage and a hardened and ground rectangular steel bar *M*. The sides of the bar are ground flat and parallel to each other. Being long enough to extend across the full diameter of the largest ring casting to be machined, the bar is bored somewhere near the center of the length to receive the cylindrical rod *A*. The hole must be machined perpendicular to the bar sides.

When the attachment is inserted, the foremost plunger *J* holds the levelling device firmly in position. The width of bar *M* need only be about one and one-half times the outside diameter of the rod. To reduce the weight of the bar a slot is machined into the front side. This slot extends almost the full length of the member, but is terminated close to each side of the hole, as indicated by the broken lines.

In use, the casting is first lightly gripped in the four-jaw chuck and allowed to project a distance sufficient for machining. The bar with the levelling device mounted is placed, preferably in a vertical position, against the face of the work-piece. Then the casting is tapped at top or bottom until the spirit level shows a horizontal setting. The chuck and work-piece are revolved by hand about a quarter revolution to make a second similar check, with bar *M* again held in the vertical position. When the level records the horizontal settings at both positions, the casting will be gripped true.



Forging-die cavities are now being sunk in Stellite by the Elox electrical discharge process. Previous normal practice was to weld Stellite only at sharp corners and wear points. Now, this material is welded to the entire die, and an electrode sinks the cavity in 75 per cent or less of the mechanical process-time requirement. A master cavity is used to cast the electrode, which is made of Elomet (a zinc and tin alloy) and which conforms to the die contour. The forging die (right) produced 20,000 pieces before being reworked (left). "Stellited" dies have been displaying as much as five times the wearing qualities of conventionally made dies.



Designing Jigs and Fixtures for Resistance-Welding

INMON V. HALE

JIGS AND FIXTURES used on resistance-welding machines, while fairly simple to construct, have certain peculiarities with which the designer has to be familiar. They differ from ordinary jigs and fixtures principally in the materials from which they are made and the circumstances created by the presence of a welding current.

Aluminum bronze or its equivalent is used for fixture bases, arms, clamping devices, and stops. It is also used for elements of a jig or fixture which are close to, or part of, an electrical conductor where strength or wearing property must be superior to that obtainable from brass, copper, or other non-ferrous, non-magnetic materials.

Aluminum and its alloys should be used where it is necessary to conserve weight. However, aluminum should not be used for actual current-carrying parts, because oxidation will develop eventually at the joint or clamp of an aluminum conductor and sometimes be the source of serious trouble.

Non-magnetic cast iron is used frequently for parts of a jig or fixture near or in the magnetic field of the welder. It is cheaper than aluminum or bronze and slightly stronger than ordinary cast iron. Fixture bases, frames, and machine arms are frequently made of this material, sometimes known as nickel iron.

Copper is mentioned last, since it is the most familiar. Its importance in resistance-welding jigs and fixtures is comparable to that of iron and steel in the jigs and fixtures for other machine tool operations. Rolled copper in flats and rounds, cast copper, and hammered or forged copper are indispensable. Copper tubing, or stainless- or seamless-steel, high-strength annealed tubing cast into copper, should be used wherever possible for water cooling, since holes drilled in copper castings usually permit water leakage that is difficult to stop.

Frequently, it is necessary to alter a welding machine in some way to better adapt a jig or fixture for the desired welding method. Rocker-arm spot welders can be easily converted for a small butt-welding job by substituting simple work-holding clamps for the electrodes. For a short seam-welding job, the upper or lower electrode can be replaced by a roll or roll segment. These spot welders cannot, however, perform flash-welding or projection-welding satisfactorily.

Motor-driven air- or hydraulically operated press type welders can be readily changed for projection-welding or spot-welding by simply altering the electrodes. It is essential that all projection-welding electrodes be located directly on the center line of pressure application, and that the lower arm be sturdy enough to avoid deflection. Press type welders cannot be readily converted for flash-welding or seam-welding.

Butt welders and flash welders can each perform the work of the other. Converting them is more a method of operating than any real change in the machine structure or controls. Standard seam welders can produce either straight or cir-

cular seams, but are not easily adapted to other types of resistance-welding.

Some Rules for the Designer

1. Keep All Magnetic Materials out of the "Loop."

By "loop" is meant the gap surrounded by the upper and lower arms, the electrodes, and the machine base housing the transformer. This gap is an intense magnetic field. Iron or steel placed in it attracts the magnetic lines, and sometimes even melts. Ferrous metal in the loop chokes the available welding or heating current back from the electrodes, reducing the welder's efficiency.

2. Keep the Loop as Small as Possible.

Too big a loop often causes poor results in setting up fixtures. Frequently, a machine with a 24-inch loop is used where one with a 12-inch, or smaller, loop may be better. Also, the over-all height of the fixtures should be kept to a minimum. All this again increases welder efficiency and makes it possible to handle jobs which may seem too heavy for the machine, thus eliminating excessive losses from greater reactance and a lowered power factor.

3. Make All Electrodes Easily Replaceable, and Water-Cool Them Close to the Tip.

Standard electrode tips can be used for most spot-welding fixtures. These tips are readily obtained and inexpensive to replace. The inlet water tube should be not less than 3/16 to 3/8 inch inside diameter, depending on the job.

4. Insulate All Gage Pins, Clamps, Locators, and Index Pins.

Where locating pins touch the work, they must be insulated from the current-carrying plate or fixture base by being pressed into a fiber, Bakelite, or other such non-conductor sleeve, which in turn, is pressed into the fixture base. If a gage pin or stop touches both parts being welded, it should be easily replaceable, because current shunted across the pin has no respect for the hardest of alloy steel, and will pit and burn it. Some fair results have been obtained by chromium-plating the pins to prolong their life.

5. Provide Ample Cross-Section to Current-Carrying Members, and Run Them Close to the Electrodes. Use as Few Breaks or Connections in the Circuit as Possible.

Welding current is extremely high in ampere capacity and carries from 3 to 20 volts, depending on the machine and the job. Conductors can carry only a limited current, depending on the material of which they are made and their cross-section. If the current is too great, excessive voltage drop and increased resistance will result. The fixture may then be useless unless the conductors can be enlarged. And again, if the current-carrying part of the fixture is built up of many sections, the reduced effective current at the weld (through losses in passing the current from section to section) will lower operating efficiency and create costly service and maintenance charges.

To calculate the size of the conductor cross-section, these current densities, based on a 50 per cent duty cycle (speed of operation), are recommended: for rolled copper sections, up to 1800 amperes per square inch: for cast copper sections, up to 1500 amperes per square inch. Water cooling of either material practically doubles its capacity. Conductors made of other non-ferrous material can be used, provided their cross-section is large enough.

A low-duty cycle allows more current to be carried per square inch of conductor cross-section than a high-duty cycle. Where breaks or connections have to be made, the clamping surfaces must be at least twice the area of the cross-section. They should be scraped smooth and parallel, and bolted together solidly.

6. Protect Slides, Bearings, Index Pins, Adjusting Screws, and Locating Devices from Flash.

This precaution is particularly necessary on flash welders, although on spot and projection welders some flashing is inevitable. Where two to four thousand welds are being made per hour, flashing can cause considerable trouble by arcing across insulated pins to produce a direct electrical short, or by fusing machine slides and making repairs necessary.

7. Provide Adjustment for Electrode Wear.

Most electrodes for spot-welding are pure copper. In a production run, they wear down, and eventually fail to maintain a pressure contact with the work. They then must be adjusted either by raising the entire lower arm or fixture, or be replaced with re-faced or new electrodes. Not only must electrode adjustment be provided to maintain a constant pressure contact, but stops, gage points, and pins must be large enough to function at both the original and the worn-down electrode height.

8. Consider the Welding Pressure.

Fixture design should be such that the upper and lower electrodes are parallel and resist deflection under the final welding pressure. If necessary to projection-weld at a slight angle, the projection should be elongated in the direction of the possible slide. Flash-welding clamps should

be designed to clamp the work with at least double the final pressure, to prevent slippage and assure good electrical contact. In rocker-arm machines, the welding height, or point where the electrode touches the work, should be in direct horizontal line with the fulcrum point of the arm, so that no slipping or wiping of the electrodes on the work happens when pressure is applied.

9. Make Welding Safe and Easy.

Ease in loading and unloading the work must be considered. One feature of welding fixtures is that they must be designed to accommodate the loading of two or more separate parts that become, as a result of the welding operation, a single part that can still be unloaded properly. The danger to the operator from electrical shock when loading and unloading is remote, provided there is no primary short in the machine.

The secondary current, or welding current, is of low voltage and is entirely safe, even though the secondary circuit is unprotected. However, for the operator's protection, only one side of the secondary circuit—either above the upper electrode arm or below the fixture base—should be insulated from the base of the machine. Also, the machine should be grounded so that if a primary short develops in the transformer or controls, it will be positively grounded through the machine and not through the operator, as would happen if both sides of the secondary circuit were insulated from the machine base, and the operator were touching both electrodes or their supports. Guards on hand-loaded electrode dies give added protection to the operator. The use of two control buttons that must be pushed by both hands of the operator is a simple means of assuring absolute safety.

10. Make the Jig or Fixture Suit the Job and Machine.

The machine to be used and the quantity and size of the work bear directly on the type of fixture. Once the welding method is determined, the work should be examined carefully to provide for sufficient electrode surface and clearance. Welds must be in the best possible position, specified material must be weldable, and provision must be made for clamping and gaging. Further, allowances for flash-off have to be included. Projections should be of correct size and shape, or the right amount of lap used. If possible, sample welds should be made and tested before the jig or fixture is designed and built.

11. Provide Sufficient Water Cooling.

Often, water cooling is neglected, and only brought to attention when overheating, excessive electrode wear, or transformer burn-out develops. On a high-production job, where the electrodes are welding with each stroke of the machine, running continuously, a separate water-cooling line should be provided for each electrode. The system should include a sight drain-pot which can be inspected frequently to assure a flow of cool water. Regulating valves permit flow-rate adjustment, and thus conserve water.

There are various methods of water cooling. A flood system involving a constant external flow of water into a drain pan is very efficient, particularly for seam- or line-welding. Troughs cast in the sides of a fixture support give a greater cooling surface than does a drilled hole. Piping integrally cast in copper sections should be used where bends in the path are necessary.

If small jigs are to be handled frequently, several of them should be available, so that they can be interchanged at intervals, and thus allowed to cool sufficiently for handling. Welding completely under water is always possible, but care should be taken to provide a suitable container so that the water will not splash over the operator or floor.

* * *

Changes in Forging Sizes and Materials

A study prepared for a booklet on forge-shop modernization, by Chambersburg Engineering Co., Chambersburg, Pa., shows some interesting changes that have taken place in forging materials and the size of forgings in the last ten or twelve years. In the late 1940's and early 1950's, stainless-steel alloys were the toughest materials available commercially in large quantities. The wide use today of alloys like titanium, niobium, thorium, zirconium, and other improved alloys developed largely since that time is presenting new forging problems. This is due to their greater resistance to deformation and their narrow range of forging temperatures. Coincident with this change in materials is an increase in the size of forgings.

These changes are reflected in the size of forging hammers sold in this period. For example, in the field of gravity drop-hammers, in the period 1947-1951, hammers of 1200 pounds and under accounted for 30 per cent of the companies' sales. During the period 1952-1956, hammers of 1200 pounds and under accounted for only 5 per cent of sales. In the 2000-pound class, however, sales were 22 per cent in 1947-1951, and 25 per cent in 1952-1956. The sales of hammers in all weight classes over 2000 pounds increased in the 1952-1956 period.

Punched Tape Speeds Code-Rod Drilling

One model of a wire printer employed for recording results of data-processing equipment has thirty code rods each with over 1100 holes accurately arranged in a different pattern. A special tape-controlled drilling machine produces all the holes required in any specific rod in about fifteen minutes.

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AMONG MACHINES for rapid and precise drilling of small holes, one developed by the International Business Machines Corporation at its Endicott, N. Y., plant is unique. Scarcely less unusual are the code rods on which this machine operates.

Controlled by punched tape, the special, code-rod drilling machine (Fig. 1) is used to produce 1100 to 1400 holes 0.035 inch in diameter. These holes are spaced within plus or minus 0.001-inch limits on 0.026-inch center distances, measured parallel to the axis of the rod, and have an angular location tolerance of plus or minus 1 degree from one of seven radial planes that equally divide the periphery of the rod. The drilling of all holes in each code rod is achieved in only twelve to fifteen minutes.

Although called a "rod," the drilled portion of the work-piece is actually a cylindrical tube of stainless steel only 0.121 inch in diameter having an 0.018-inch wall thickness. Each hole passes through this wall, and in some instances, as many as three holes are drilled simultaneously in the same plane normal to the axis. To accomplish this result, the code-rod drilling machine incorporates seven, punched-tape-controlled, Keller air drills which are equally spaced around the rod as shown in Fig. 1. A lead-screw, also controlled by tape, automatically indexes the rod vertically.

Since the tube is secured against any change in angular position during the complete drilling cycle, the holes are produced in seven parallel and equally spaced rows. This is, in fact, a prime requirement for the proper functioning of the finished rod. There are thirty code rods, each with a different drilling pattern, employed in one type of wire printer designed to record the results of computing and data-processing machines. Input to these machines is normally at a high rate. The wire printer makes possible the recording of these results at a corresponding speed—many times faster than an operator could achieve manually.

In the operation of the wire printer, each code rod is given both axial and angular motions, stopping at each indexed position momentarily for certain wires which move parallel to their own

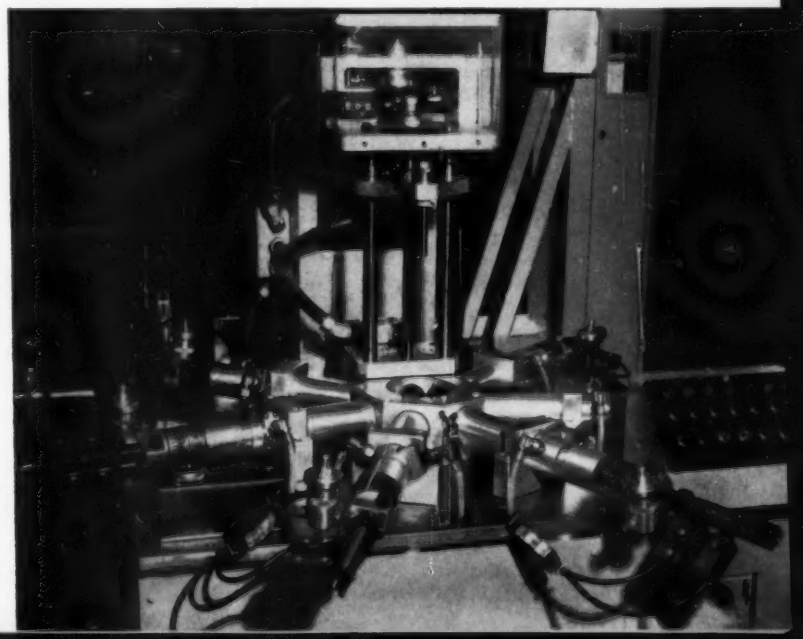


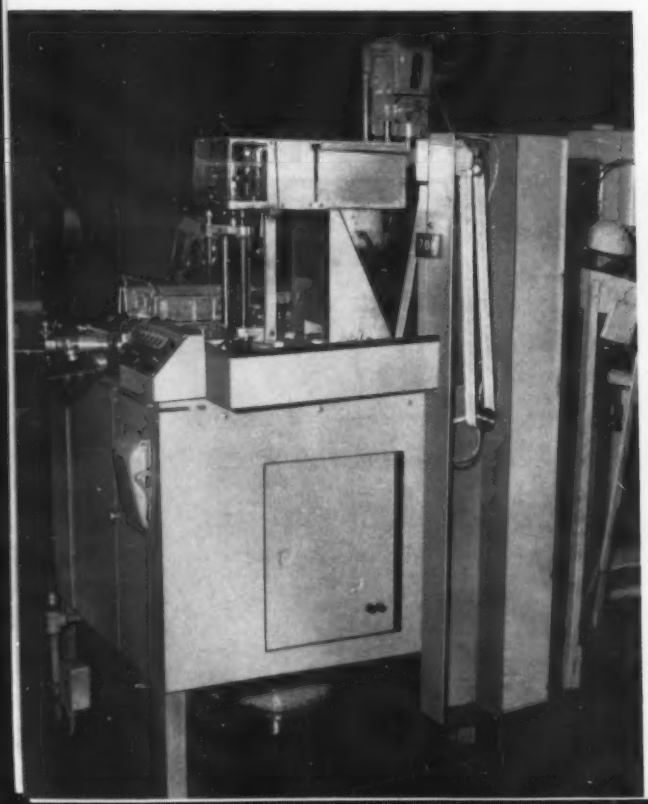
Fig. 1. This seven-spindle drilling machine automatically produces 1100 to 1400 accurately spaced holes in code rods for a wire printer that is used in combination with computing and data-processing equipment.

axes to enter and then retract from a certain group of holes determined by the code position. During this short interval, a numeral or a letter is printed on a tape or on forms by means of a print head at the opposite end of the group of wires. This method of operation makes it necessary that the holes be accurately located.

In the first setup employed for code-rod drilling, a single drill moved by a manually controlled pantograph was employed. A skilled operator on this machine could drill 1114 holes in one rod in about four hours. A second method, using guide racks for each row of holes but having a single air-operated drill, tripled the production rate. With the adoption of the tape-controlled setup (Fig. 1), however, output has been increased two and one-half times over the previous arrangement.

Although each type of rod involves a different hole pattern, no changes in tooling are needed. The punched tape controls which of the seven drills is used in each advance, as well as the indexing of the rod, and the tape is punched to care for variations in drilling pattern.

In each vertically indexed position of the rod, the number of holes may vary from one up to as many as seven, but usually fewer than seven are required. As no more than three holes can be drilled simultaneously without drill interference, and seven holes are specified at a given level, three separate advances of one or more drills are necessary. Lights on a pilot panel always show which drills are operating.



Each drill is pneumatically advanced and retracted but the valves controlling these motions are operated by solenoids. Advance is controlled by tape, but retraction depends upon activation of a limit switch set to operate as soon as the drill passes through the tube wall. This setting must always prevent the drills from interfering with each other when more than one is used simultaneously. All drills are made of high-speed steel and are necessarily kept sharp to produce clean and true holes at the high feed rate. When broken drills are removed for regrinding, resetting is always a precise operation. A stream of coolant is directed at each drill to wash away the chips.

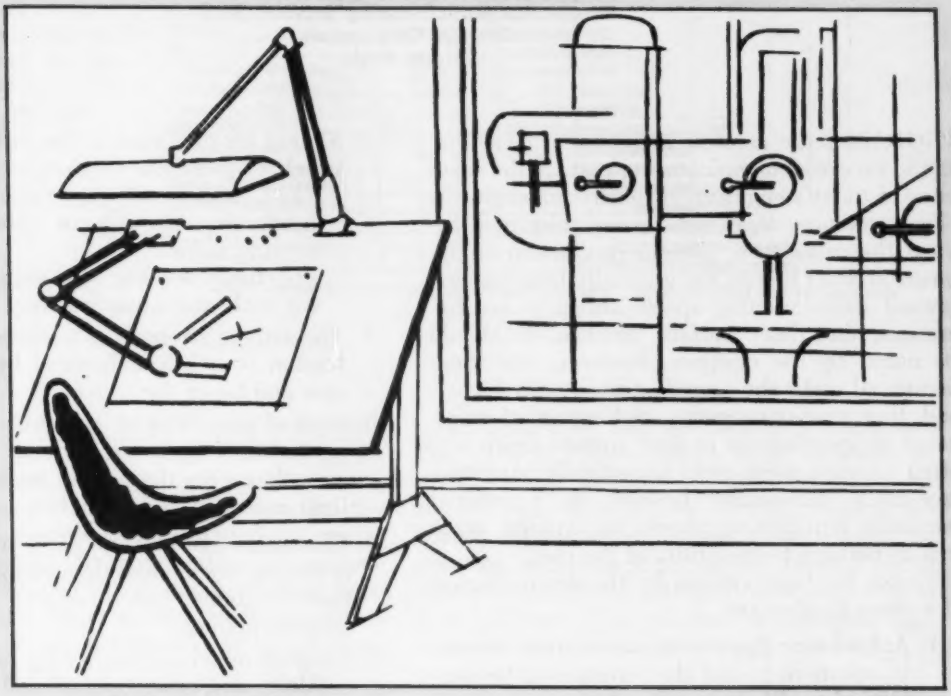
Spacing of the holes axially along the length of the rod is accomplished by vertically indexing the rod in 0.026-inch steps with a precise lead-screw. The drive for this screw has two clutches, one turning continuously, and the other actuated by impulses that are controlled by the punched tape. A 4-to-1 ratio gear train is used in combination with the screw to provide the precise indexing movement required. A subtracting type of counter is geared to the indexing head to indicate which of the 288-hole groups is being drilled.

Drilling can be done from either top to bottom or bottom to top by setting the tape drive correspondingly. After the holes required at the initial position are drilled, the lead-screw automatically indexes the rod in a vertical direction, and the holes for the next level are produced. This cycle repeats until all holes are completed, whereupon an indicating light flashes, the machine stops, and a new rod is inserted. When the start button is pressed, the next cycle can produce an identical rod or one with another hole pattern, depending upon the portion of the punched tape employed.

The tape, driven by a pawl and ratchet linked to an eccentric, is moved in synchronism with the indexing screw. The punched tape is seen at the right in Fig. 2. A given tape is used many times and, being continuous, will, in time, repeat the different cycles represented by the tape punchings. Consequently, it is not necessary to change tape as long as rod sets with the particular hole patterns made by the tape are required. If necessary, a new tape can be inserted in a few seconds at the end of a given cycle. Besides giving fast production (considering the number of holes per piece) the machine, when provided with a suitable tape, can produce the required set of thirty different rods as easily as it can make thirty duplicates. Tapes are not difficult to prepare, are easily replaced, and wear very little in service.

Fig. 2. Air-operated drill heads and the lead-screw for vertically indexing the code rods are controlled by the punched tape seen in the cabinet at the right.

MACHINERY'S *Reference Section*



WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

October 1958

What the designer should know about production--Part 2

SPECIFYING TOLERANCES and SURFACE FINISHES

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PROBABLY the greatest single factor contributing to excessive manufacturing costs is the tendency of today's engineer to specify unnecessarily close tolerances or, in some cases, tolerances beyond the capacity of present production equipment. Product design has gradually been moving toward more exacting specifications, closer tolerances, and finer surface finishes. It should be noted by the designer, however, that these factors all make the manufacturing costs higher, and that any unnecessary tightening of tolerances or specification of finer surface finish will often increase these costs fantastically. Any surface-finish refinement beyond its functional minimum requirement should be avoided, since it adds nothing to the utility of the part.

Today, the basic criteria for the determination of surface finishes are:

1. Assemblies: Type of fit, ease or interference in assembling, and the function to be performed.
2. Sliding Surfaces:
   (a) Surface roughness requirements are determined by friction between surfaces, lubricated or unlubricated.
   (b) Wear increases with increased surface roughness.
3. Sliding fits may stick if the surfaces are too rough, or gall if the surfaces are too smooth.
   (a) Cylinder walls may be so smooth that lubricating oil will not adhere, thereby causing failure.
   (b) Reciprocating rods may score packing seals and cause leakage.
4. The fatigue strength of surfaces stressed in tension is greatly influenced by the roughness and lay of the surface.
5. Optical properties of reflectors and related parts are largely dependent on surface smoothness for the quality and accuracy of light reflection and refraction.
6. Chromium-plated trim parts require some polishing, the amount depending on the surface roughness and quality of the surface prior to plating.

Surfaces of materials finished by milling, turning, grinding, and other operations have proved to be, for all practical purposes, of the same quality, if each has substantially the same waviness and roughness. Such surfaces, produced by different operations, will perform with equal satisfaction. Waviness and lay do not ordinarily require specification because these are normally produced by experienced operators using ma-

Table 1. Natural Surface Finishes Generally Obtained in Various Production Processes

Process	Surface Finish, Micro-Inches
Sand-Casting	1000 to 250
Forging (Closed Die)	250 to 100
Permanent-Mold Casting	250 to 40
Rolling	250 to 10
Extruding	250 to 10
Die-Casting	100 to 20

Table 2. Best Possible Commercial Surface Finish Obtainable on Various Metals by Any Machining Method

Material	Surface Finish, Micro-Inches
Aluminum	16
Brass	14
Gray Cast Iron	5
Soft Steel	5
Hard Steel	2 to 0.5

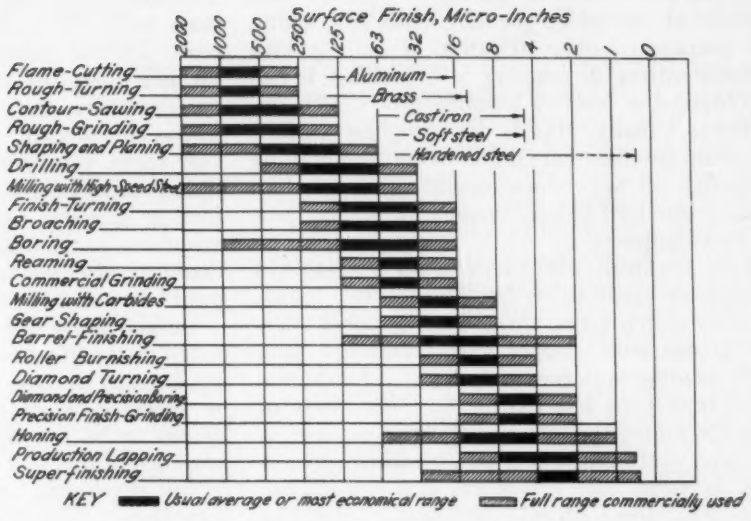


Fig. 1. Commercially possible and most economical ranges of surface finishes that can be produced by various manufacturing processes.

chine tools and cutters in good condition. They will generally produce a surface satisfactory for most applications.

The development of the Profilometer and the Brush Surface Analyzer has provided the means for establishing quantitative values for surface roughness standards. These standards have been published by the American Standards Association as B-46.1 "Surface Roughness, Waviness, and Lay," defining the surface symbols to be used on drawings. The majority of the firms in the automotive industry have reissued these standards with more detailed explanations and under their own assigned numbers.

Prior to World War II it was the practice to note finished surfaces ambiguously, i.e., "Grind," "Machine Finish," "Polish," "File," etc. The parts were usually accepted by the inspector on visual appearances and his own individual knowledge of its end use and assembly, or functional problems. Today, there are still far too many detail drawings carrying such notes or symbols as "G" for grind and "F" for machine finish. It is now possible, however, to remove all doubt as to the quality of surfaces by following standards.

Whenever product engineering releases a new assembly to manufacturing, the process engineer's prime problem is to specify and line up the machines necessary to hold the specified dimensional tolerances, and at the same time obtain the quality of surface finish desired. As a rule, the closer the tolerance the finer the finish.

Standard surface roughness numbers generally range from 1000 micro-inches to 1 micro-inch. The 1000- to 500-micro-inch range indicates extremely rough surfaces produced by heavy cuts and coarse feeds in milling, turning, shaping, and boring; flame-cutting; rough filing; rough disc grinding; and snagging. Surfaces of such roughness are suitable in cutting off material for clearance purposes. The practical dimensional tolerance for this type surface is approximately plus or minus 1/16 inch.

Surfaces having a finish of 250 micro-inches definitely show tool marks resulting from a rapid feed. This surface can be produced by coarse surface grinding, smooth disc grinding, shaping, planing, sawing, drilling, and milling. It is by far the most popular for general use. In automotive work it is suitable for machined clearance surfaces and Class 2 chased threads, and suitable in appearance for most external surfaces. The practical dimensional tolerance for this type of surface is usually plus or minus 0.010 inch.

A surface finish of 130 micro-inches can be produced by high-grade machine work in which relatively high speeds and fine feeds are used in taking relatively light cuts with well-sharpened cutters. This surface is suitable in automotive work for soft gasket faces, die or tap cut threads, datum or locating surfaces used for tolerances greater than 0.001 inch, mounting faces, and brake drums. It is suitable for use where close fits are required on external or internal machined parts. Practical dimensional tolerances for this type of surface are plus or minus 0.005 inch.

A finish of 50 micro-inches can be obtained with carbide turning or boring, or by centerless, cylindrical, or surface grinding. Also, it is within the average commercial range of milling with carbide cutters, or reaming or broaching. It can be obtained as well by burnishing or similar operations. Usually, this is the roughest surface requiring specification on a drawing, and may be quite difficult to produce repetitively in production on standard lathes, shapers, or similar production equipment.

A surface finish of 50 micro-inches is suitable in automotive applications for bearing-shell backs, flywheel clutch faces, main bearing bores, rear-axle grease seals, copper gasket surfaces, gear teeth, locating or datum surfaces used for dimensional tolerances less than 0.001 inch, press or push fits, milled threads, sliding surfaces, keys or keyways, worm-gears, general-use rolling surfaces such as cams and followers, and general-use rotating surfaces such as pivot pins and holes. The practical dimensional tolerance for this type of surface is plus or minus 0.0025 inch.

A surface finish of 25 micro-inches can be produced by fine centerless, cylindrical, or surface grinding; precision boring or turning; precision carbide milling; roller burnishing; honing; lapping; barrel finishing; and related processes. This finish is seldom specified unless it is of primary importance for proper functioning of the part. Typical automotive applications include surfaces used for static sealing rings, cylinder bores, pistons, cam lobes, rod bushings, ground screws or worms, piston-rods, heavily loaded gear teeth, precision journal bearings, precision sliding surfaces, precision rotating surfaces, and friction surfaces such as clutch plates, brake cylinders, piston skirts, valve guides and stems. Practical dimensional tolerances for this finish would be plus or minus 0.0015 inch.

Surface finishes of 10 micro-inches can be produced by the finest centerless or cylindrical grinding, honing, lapping, or buffing. They should only be specified when coarser surface finishes are known to be functionally inadequate. The appearance of this and finer finishes may be bright or dull, depending upon the method used to produce them. Typical automotive applications are axle shafts, bearing races, valve seats, rolled threads, camshaft bearings, and oil pump driveshafts. The practical production dimensional tolerance is plus or minus 0.0005 inch.

A finish of 5 micro-inches can be produced by honing, lapping, superfinishing, very fine buffing,

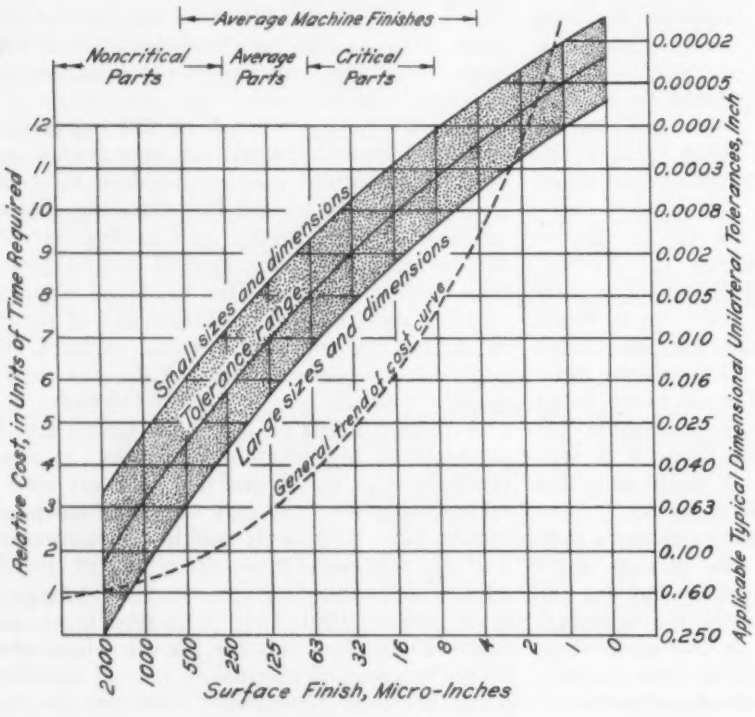


Fig. 2. Relative costs and applicable tolerances for different surface finishes. As can be seen by the broken line, the cost increases as smoother finishes are required.

Table 3. Surface Finishes Obtainable with Various Machining Operations

Process	Surface Finish, Micro-Inches	
	Average	Best
Milling or Planing	180 to 60	40
Turning	100 to 40	30
Grinding	60 to 10	6 to 2
Precision Turning, Boring, or Grinding	40 to 20	2
Honing or Lapping	16 to 4	1
Superfinishing	4 to 2	0.5

burnish-grinding, or precision boring. This surface is very expensive to produce and should only be specified if such a degree of surface refinement is absolutely essential. Typical automotive applications for this finish are crankpins, fluid-coupling oil seals, main journals, piston-pins, tappet barrels and heads, and pressure-lubricated bearings. Typical practical production dimensional tolerances for this finish would be plus or minus 0.0001 to 0.00025 inch.

Natural surface finishes that can be expected on parts that are cast, forged, rolled, or extruded are listed in Table 1, and the best surface finishes that can be produced on different metals by any machining operation are given in Table 2. The over-all and normal ranges of surface finishes that can be produced commercially with various machining processes are presented graphically in Fig. 1, and the relative costs and applicable tolerances for different surface finishes are shown in Fig. 2. Tolerance ranges given are merely indicative, and should not be applied without an adequate study of the particular process under consideration.

A condensed listing of the surface finishes obtainable with the more basic methods of machining is given in Table 3, while the practical and minimum unilateral tolerances recommended for production when different surface finishes are specified are shown in Table 4. Special, precision toolroom equipment, and temperature-controlled work areas may be required to maintain some of the minimum dimensional tolerances listed. In such fine finishing operations as honing, lapping, superfinishing, and barrel finishing, dimensions are changed by only 0.0002 inch or less. In roller burnishing and similar operations, no stock is removed and the higher ridges on the metal surfaces are merely folded over.

The rapid increase in cost involved when additional machines and operations are required to obtain closer tolerances and finer finishes is indicated in Table 5. In addition to excessive costs, the specification of close dimensional tolerances and very smooth surface finishes may result in high scrap losses, reduced production, and additional labor requirements. For these reasons the product designer should never specify a closer dimensional tolerance or finer surface finish than is commensurate with the functional use of the part and the limitations of the machines and methods available for producing the part. Whenever possible, the products should be designed for inexpensive production machining and rapid assembly. Any tolerance less than 0.005 inch should be closely checked and proven to be absolutely essential.

Tolerances that have been discussed and listed in Table 4 pertain to a single dimension on a part or the distance from one datum surface. The concentricity of several holes in the same part, dimensions between holes, or the distances of several surfaces from a common datum plane cannot be maintained to the same degree of accuracy as a single tolerance.

A good example of this is the hydraulic steering pump and bushing assembly seen in Fig. 3. In this part, three concentric diameters are bored to a unilateral tolerance of 0.0005 inch each. One surface is bearing metal. The remaining two bores are in the cast-iron housing and are of different lengths. The bottom of the smaller bore in the housing is held to a runout of 0.001 inch total indicator reading. While the precision boring machines now on the market are capable of holding a production tolerance of 0.0005 inch, and in some instances, 0.0002 inch on a single diameter, machine vendors refused to guarantee diametral tolerances of less than 0.001 inch and still meet production volume requirements. Also, they insisted on a stationary boring-bar without "tool-

Table 4. Relation of Surface Finish to Practical Production Tolerances

Usual Surface Finish Range Allowed in Production, Micro-Inches	Practical Unilateral Tolerance in Production, Inch	Best Surface Finish Possible, Micro-Inches	Minimum Unilateral Tolerance in Production, Inch
1000 to 250	1/8	250	0.008
180 to 60	0.020	40	0.0008
100 to 40	0.010	16	0.0002
40 to 20	0.005	8	0.00015
20 to 6	0.003	4	0.00008
8 to 4	0.001	2	0.00005
4 to 1	0.0004	0.5	0.00002

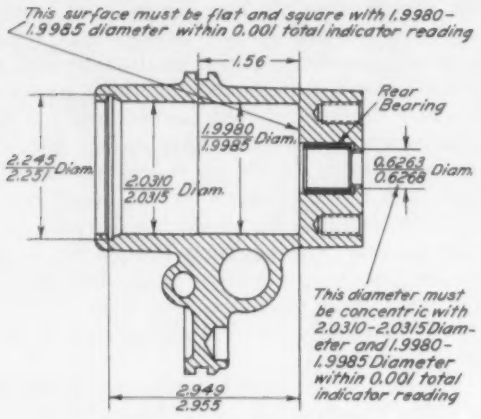


Fig. 3. Difficulty is encountered in holding three concentric diameters in this hydraulic steering pump and bushing assembly to a tolerance of 0.0005 inch each.

relief back-off" to hold this tolerance. Machining of the ring groove was thus automatically eliminated and required an additional operation.

Tolerances on the outside diameters of the mating parts for this pump assembly are also 0.0005 inch. However, it would be much easier to hold these diameters to a 0.0002-inch tolerance with precision grinding and allow the 0.001-inch bore tolerances requested by the vendors. This would, for all practical purposes, maintain the same clearances in assembly, and would be preferable to insisting that production engineering process the assembly "as released."

Multiple bores, step bores, and cross bores seem to receive the same intolerable tolerances from the designer—too close to be held on production machines. This situation and similar problems could often be eliminated at the start if the designer had a good working knowledge of manufacturing machines and their capabilities. However, in no case should manufacturing engineers expect designers to forfeit their responsibility for designing a part that will satisfy its functional requirements. If the part is difficult to make and its specifications cannot be adapted to suit simpler manufacturing methods, it is the job of the production men to find ways to make it.

Table 5. Comparative Machining Costs for Various Allowable Tolerances

Allowable Unilateral Tolerance, Inch	Comparative Cost of Machining
0.125	1
0.040	2
0.030	3
0.020	4
0.015	5
0.010	8
0.005	14
0.003	19
0.001	24
0.0005	36
0.00025	54

Surface roughness is determined by comparing it with a master surface of known, uniform roughness. Such comparison is made by manual feel, surface exploring instruments, or optical means. The master may be a standard surface finish specimen (or an accurate replica of such a standard) or a control piece-part having surface characteristics conforming with the specifications. Visual inspection is not always reliable, primarily because of light reflections, or because the piece being inspected may be of a different material than the sample, and may have been machined differently. For these reasons, it is recommended that the comparison be made by feel or suitable measuring instrument.

When one work-piece has been machined and accepted in accordance with the specifications, it can be used as a control part to compare pieces produced subsequently. There are occasions when the decision is marginal, and it will be difficult to agree as to whether or not the piece conforms with the sample. This is particularly true of smoother finishes, where it is usually necessary to employ a profile measuring instrument.

To inspect for surface waviness, bluing or light gages and any standard device for linear measurement can be used. Measurement of waviness less than 0.0001 inch ordinarily requires the use of optical flats or similar devices.

Does Your Plant Have a Pension Plan?

ROBLEY D. STEVENS
Management Consultant
Washington, D. C.

EMPLOYE PENSIONS are basically a modern problem, although for many years employers have operated such plans. In view of recent developments, a reconsideration of any company's employe pension requirements at this time may be advantageous.

The total economic strength of a plant depends to a large extent on the skill, initiative, and creativeness of its personnel. Realization of the necessity for replacing people when they retire or die has created the current interest in pension plans. Favorable tax regulations applicable to employers who set up approved plans have contributed to this new interest. In addition, the establishment of union pensions has been spurred by the absence of a sufficient number of company plans, and by the so-called inadequacy of old-age benefits currently paid under the Social Security Act. Today, millions of workers are covered by pension plans in some form, either those established by employers, or initiated as a result of collective bargaining.

A pension plan provides regular periodic payments, or annuities, to plant personnel who retire, or who are retired from service for one or a combination of the following reasons: They have reached a certain age called the normal retirement age; they have served a minimum number of years; or they have become permanently or totally disabled. Usually, the pension or annuity is paid only if the retiring plant employe meets the age and/or service requirements, or is totally disabled.

Under some pension plans, however, other conditions for retirement are provided. For instance, an employe retiring or otherwise leaving the company employ before the normal qualifying period, but after a stipulated age or period of service, may receive a reduced annuity beginning immediately on separation, or a deferred annuity with pension payments beginning at the normal retirement age. If, however, the pension plan is a contributory one, an employe on separation from service before retirement may choose between an annuity or a lump-sum refund of his contributions, with or without interest.

There is no one pension plan that fits the needs of every plant. The final choice and the provisions which are written into it will depend upon analysis of numerous factors. In any event, legal counsel can be helpful throughout the development and administration of a pension plan, as will the services of an insurance firm in addition to pension specialists.

An absolute answer to the question of who pays will probably always be far from settled, because plant management views the adoption of a pension plan as an additional cost. The solution here would seem to be a better and more analytical approach by plant management as to financing the pension plan. According to the advice of experts, methods of financing entail the following: The plan may be financed by the employer alone, or jointly by the employer and employe; it may be operated through a fund, a trust fund, or an insurance policy, or financed on a pay-as-you-go basis; and contributions may be stated as a flat amount, percentages of wages or payrolls, or an amount per unit of production. In a contributory pension plan it is quite common for the employer to match the employe's contributions. Since a sound pension plan should be custom-built to the particular requirements of a plant, it is not always realistic to put an arbitrary dollars-and-cents price tag on the financing of it.

Who is eligible to join, and who is eligible to retire? The answer to that question is this: Eligibility for participation in the pension plan is usually based upon service, age, and occasionally, upon union membership requirements. Employes entering plant service after specified ages, 45 and over, are sometimes excluded. Some plans do not cover employes until they reach 30 years of age. Others specify a minimum of five years employment service.

How large should pensions be and what are their sources? This important question is for management to decide. In search of an adequate solution, management should inquire as to how other companies have handled the matter. Various provisions are possible. For example, benefit amounts are stated as flat sums, or as a fixed percentage of income multiplied by years of service. The size of the pension can also be set by the amount of participation in some insurance program. Or, the total pension may be derived from a combination of elements according to a stipulated formula.

The type, amount, and details of the benefit

provision are a matter of company policy. For instance, a plant may pay employes a monthly pension of $50 excluding old-age social security benefits, regardless of length of employment or earnings.

When should a plant worker retire? Usually, the normal retirement age is at 65 years for men, and 60 for women. Annuities are provided in some pension plans for employes who become permanently and totally disabled before attaining the minimum and/or service requirements for retirement. To obtain this annuity, the employe must have served for a stipulated period ranging from 5 to 20 years. Compulsory retirement ages are permitted in some pension plans but forbidden by others. Some, however, under which the employe may continue to serve beyond a compulsory retirement age with the employer's permission, do not allow accrual of service credit during the extension. An employe who, voluntarily or involuntarily, leaves the employer's service before he is eligible for retirement, or who drops out of the pension plan, often forfeits his pension rights. Still other plans provide for payment of a lump sum to the employe at the time of separation.

Administration of a pension plan is generally similar in scope to that of any other employe incentive plan. (Usually, the company will publish the plan's objectives in detail in a descriptive booklet.) Pension plans may be administered by management, the union, or a committee of both, since there is no general rule governing this matter.

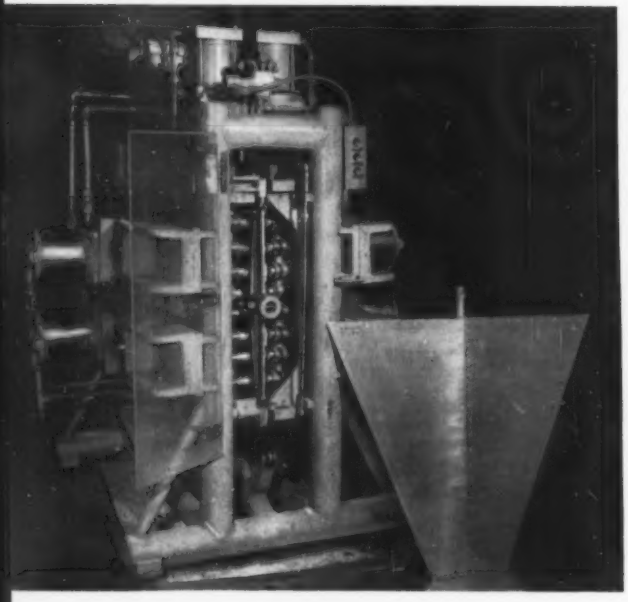
In the past several years, the number of private pensions has grown phenomenally. Today, it is estimated that there are about 25,000 different types of pension plans in effect, covering ten million employes. Any plant management which is interested in creating a pension plan has a wide range of choices. It may start with the most generalized plan, and refine it according to the needs of the firm. Pension planning is of immediate, as well as long range, benefit to a company, and therefore requires the most careful evaluation by plant management.

High-Speed Drilling of a Missile Fin

Fifty-two holes are drilled and countersunk in a Nike-Ajax fin within two minutes floor-to-floor time in the Missile Division of the Douglas Aircraft Co., Inc., Santa Monica, Calif. The Douglas-designed machine used for this purpose is equipped with Keller air-drill units. They prepare both sides of the fin of the type seen in the illustration for fabrication.

Each fin is located in the fixture by stops, being inserted in the machine by hand. The narrow end of the fin goes toward the back of the machine. After loading, the Plexiglas chip shield is swung into the closed position across the end of the unit, and the machine is started. Drills for both sides of the top half of the fin move in at the beginning of the operation to drill and countersink a series of holes. When they retract, the drills located in the bottom of the special machine perform their operation.

The fin is then taken from the machine, turned 180 degrees, and re-inserted with the small end again toward the back of the equipment. Then, the machine is started again and the drilling sequence repeated. Two steps are necessary in the operation because the center-to-center distance of the holes is insufficient to accommodate the chucks that would be required if all holes were drilled simultaneously. The hole pattern of the top drill units is staggered in relation to the pattern of the bottom drill units. Thus, by making a 180-degree turn of the fin between the two steps, the completely drilled pattern is obtained.



Special equipment designed for drilling fifty-two holes through a missile fin in an operation involving two steps and turning the fin 180 degrees between steps.

Welding Methods Fabricate Railroad Cars



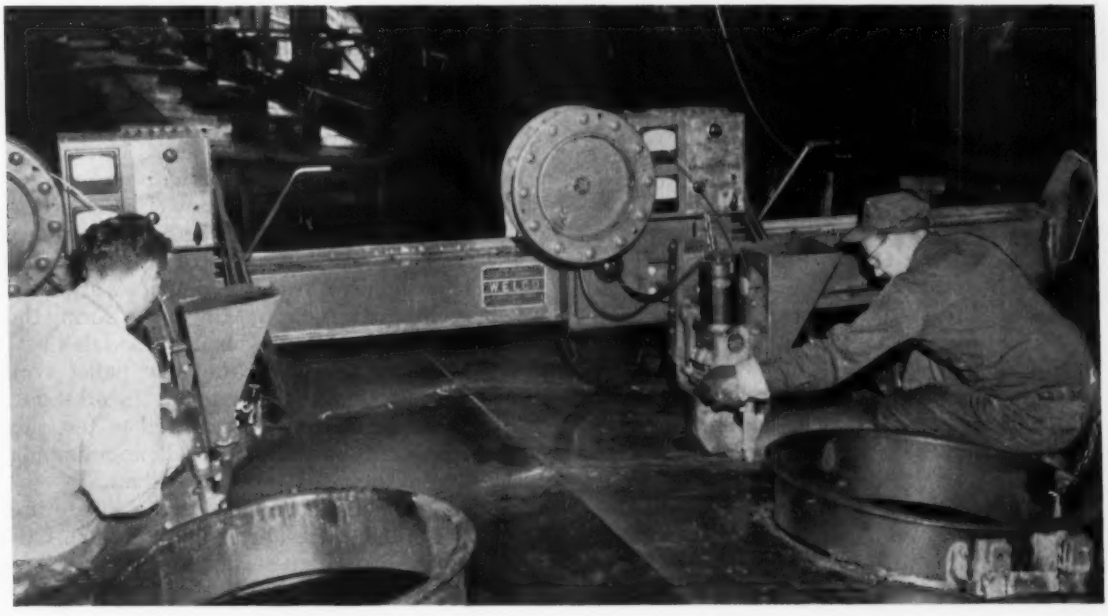
HIGH-SPEED manual and automatic welding dominate the shops of the Greenville Steel Car Co., Greenville, Pa. Shop layout, positioning equipment, and production-line methods are all geared to volume fabrication of railroad cars.

Each unit starts out as two trucks on one end of an assembly line and finishes up as a completed car. The cars are moved from station to station, each move accompanied by the addition of new sub-assemblies or accessories. Many of the sub-assemblies, such as bolsters or end plates, are built up adjacent to the station on the main assembly line at which they will be added to the car. When completed, these parts can be picked up and moved directly into place. Intermediate storage steps can thus be eliminated in a great many cases.

Sub-assemblies are tack-welded in location on the car body. The entire car is then elevated and positioned for finish welding. Thirteen welders work together on one car body, as can be seen in the heading illustration. The arc welding to be done by each of the operators is so well-planned that they start welding and finish welding almost simultaneously.

Simple fixtures are used for this operation.

Fig. 1. Automatic submerged-arc welding is being used on a railroad-car assembly line. Here, two welding heads are feeding toward the center of the car as they complete a transverse roof seam.



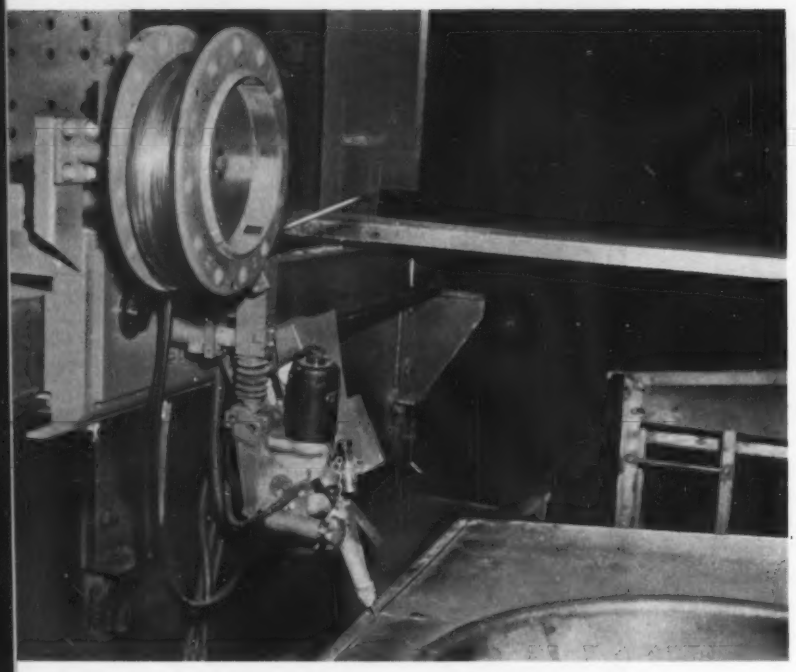


Fig. 2. Longitudinal roof seams are also submerged-arc welded automatically. At this station, the car is wedged tightly between the upright columns of the building to prevent accidental jarring.

They attach to the coupler yoke, pick the car up off the trucks, rotate the car, and lower it to the floor. After all necessary welding in this position has been completed, the car is rotated 180 degrees for further welding and then replaced on the trucks.

Most of the manual welding is done with Lincoln Electric Fleetweld 47 electrodes. This iron-powder E-6013 electrode can be used on slight downhill joints and on the poorly fitted joints prevalent in railroad-car fabrication. Low-hydrogen electrodes are used on a few joints where hard-to-weld steels are encountered, and E-6012 electrodes are used on steep downhill joints.

Automatic submerged-arc welding stations are located along the assembly line to join the roof sections. Two positions are devoted to this type of welding: one to form transverse welds, and one to form longitudinal welds.

Transverse seams are made at the first position, Fig. 1. The entire fixture—which includes two welding heads, two carriages, and a cross-beam—is placed directly on the car to avoid relative motion during welding, should the car be jarred. Each head begins to lay down a bead at the outer ends of the joint and progresses toward the center of the roof. The heads move vertically on slides to compensate for roof pitch. A 1/8-inch gap at the butt joint of the 3/16-inch thick roof plates is backed up by a 1/4-inch angle iron.

Longitudinal welds are completed at the second position, Fig. 2. Here, again, two welding heads are used—one on either side of the car. Traveling carriages support the heads and ride along beams that are fixed to the upright columns of the building.

As the car is aligned with this station it is wedged tightly between the columns so that it cannot be jarred during welding. A guide light assists the operator in making minor adjustments so as to be sure that the arc follows the joint as the welding head and carriage move along the beams. This joint—formed of 3/16-inch roof plate lapped with 3/8-inch upper side plate—is welded at a speed of 38 inches per minute.

* * *

Transfer Machine Workshop

A series of one week workshop sessions has been inaugurated by the Kearney & Trecker Corporation, Milwaukee, Wis., to acquaint industrial engineers with its new tape-controlled transfer machines. Engineers from six companies attended the first of these sessions in Milwaukee during the last week in June. More are being scheduled.

In addition to viewing the new pallet type transfer equipment at the company's workshops, the visiting engineers are permitted to test this production concept on the actual programming of parts from their own production lines.

Company officials announced that, while future groups will be formed largely by invitation, bids to attend the workshop sessions from interested companies will be welcomed.

Shot-Blasting Removes Scale Economically

New setup in Oldsmobile plant handles both sheet and coil stock, blasting both sides simultaneously and then oiling the stock before it is stacked or re-coiled.

HERBERT CHASE

AUTOMATIC SHOT-BLASTING of hot-rolled steel ranging from 0.075 to 5/16 inch thick is effecting savings for the Oldsmobile Division of General Motors Corporation. This steel is purchased in sheets, coils, and plates which are made to SAE 1008 and 1010 specifications. Formerly, similar stock was purchased in a pickled and oiled condition that added considerably to its cost. Since recently installing the shot-blasting machine, a net saving has been obtained after making suitable allowances for operating, maintaining and amortizing the equipment.

Hot-rolled steel is employed chiefly for chassis and axle components but is not used where appearance is important, as such parts are made from cold-rolled steel having a smoother initial finish. Most of the equipment now applied for the blasting operations is shown in Fig. 1. Included is an eight-wheel Pangborn automatic shot-blasting machine designed to blast simultaneously both sides of the stock as it is fed through. In addition, there are means for feeding either coil or sheet material at the required rate. After blasting, the stock continues on through oiling rolls, after which sheets are automatically stacked. When coil stock is processed, it is rewound in coils at the discharge end and transferred on a coil car. The coils are then picked up by a crane that shifts them to storage or to a pick-up point, if scheduled for direct transfer to the adjacent press shop.

The whole unit is controlled from stations (Figs. 2 and 3) having button panels at which loading and feeding are governed, and speed is adjusted. Stacks of sheet stock to be fed are set on a transverse conveyor (Fig. 4) and are advanced, one stack at a time, under an automatic pick-up device. Sheets up to 200 inches long and 160 inches wide can be picked up one at a time and fed automatically to and through leveling rolls to the blasting machine.

For shot-blasting, the stock passes above rub-

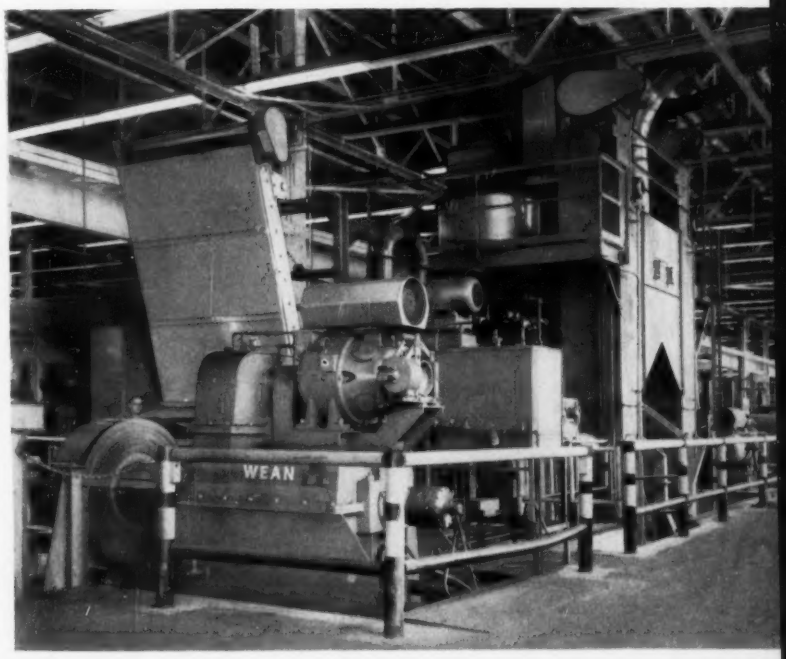


Fig. 1. General view from the output end of the installation for shot-blasting hot-rolled sheet and coil stock. Rewinding is being done by the machine in the foreground.



Fig. 2. Operator at one of the two control stations is seen regulating the uncoiling of stock for passing it through the shot-blasting machine. Coils up to 60 inches wide can be run through the equipment.

ber-covered rolls set on 24-inch centers and under similar rolls on 48-inch centers. These rolls keep the stock moving at a pre-set speed through the blasting area. There, steel shot projected from four wheels above and from the same number of wheels below the stock simultaneously strike both faces of the moving steel at an angle of about 75 degrees. This blasting is regulated to cover the whole width of the sheet uniformly but is substantially confined to the width set. Rubber blankets in the machine are hung to protect roll surface as far as possible. Bearings for the rolls are outside the wall of the machine and are thus kept away from shot and grit.

Shot velocity is sufficient to clean off all scale on both surfaces by the time sheets emerge from the blasting area. Shot, along with matter cleaned from the sheet, fall to collecting points (some being removed by "plows" above the stock) and are conveyed to points where dust is blown out, oxide is collected, and the shot is returned to hoppers for feeding again to the blasting wheels.

When sheets, thoroughly blasted on both sides, leave the blasting machine, they are passed through oiling rolls that deliver the sheets into a stacker, Fig. 5. At the moment the stack reaches a certain height, the back plate of the stacker is lifted and the stack is pushed out onto conveyor rolls for banding and pick-up by a fork truck while the next stack is built up.

Although coil stock is passed through the blasting machine in the same way as individual sheets, it must be uncoiled, the sheet feeder being moved away and a Wean uncoiler used instead. This device is equipped with an Askania regulator with hydraulic plungers that automatically shift the coil short distances in an axial direction when necessary to prevent the stock from skewing and

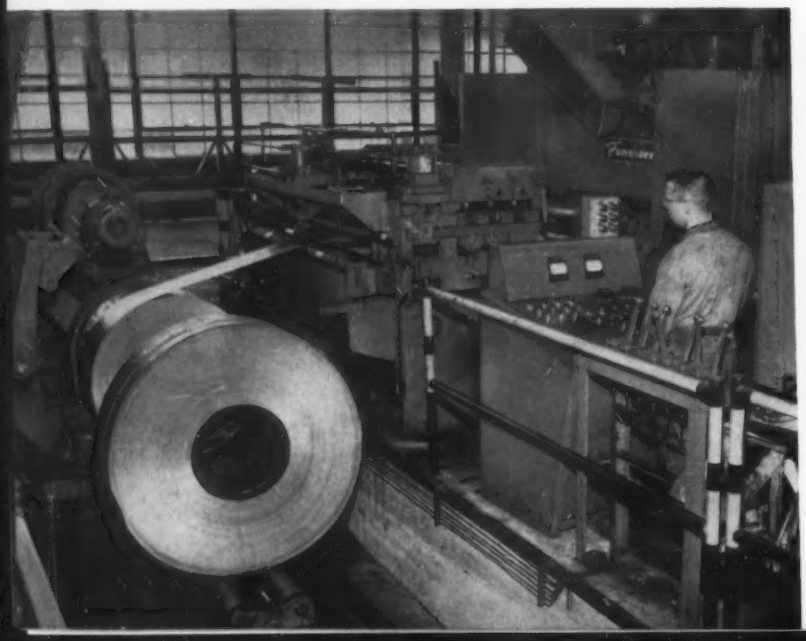


Fig. 3. Re-coiling stock after it leaves the blasting machine and has passed through oiling rolls. When sheet stock is shot-blasted, a conveyor is lowered to receive the sheets.

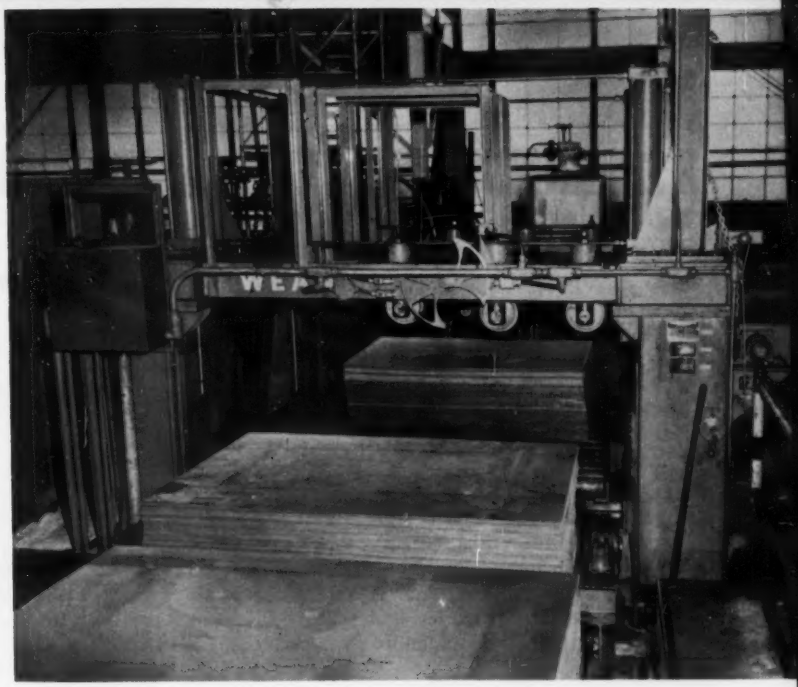


Fig. 4. Stacks of sheet steel ready for feeding into the blasting machine, the farthest stack being under a Wean feeder that picks up one sheet at a time. This unit is by-passed when coil stock is fed through the machine.

thus keep it advancing through the center of the blasting machine.

Stock advance averages about 60 feet per minute, but is varied to suit the width of stock. Narrower stock is moved faster than wide stock, the objective being to have about the same volume of shot strike each square foot of metal surface during its passage through the machine. It is advantageous, however, to use as nearly the full width of the machine as conditions permit. More than one sheet can be fed at a time as long as the total width is not greater than 60 inches. A new slitter is being installed, however, so that wide coils can be purchased rather than a larger number of narrower ones. Coils weighing up to 30,000 pounds can be handled by the uncoiling and re-coiling equipment used with the machine.

Re-coiling, as seen in Fig. 3, is done after the stock passes through rolls that apply an oil. This oil tends to inhibit rusting and is also a lubricant for dies in which subsequent drawing or forming is done. When a coil is wound to original size, a carriage lifts it off the coiler ready for pick-up.

For blasting, a mixture containing 6 pounds of No. 110 to 2 pounds of No. 170 steel shot is used. There is, of course, some wear on shot, and to keep the machine operating properly, about 100 pounds of new shot are mixed with the total volume circulating through the machine for every hour of operation. Most of the material removed from the stock is iron oxide. That which is not so fine as to be carried off as dust is collected automatically. It has resale value, partly offsetting the cost of new shot.

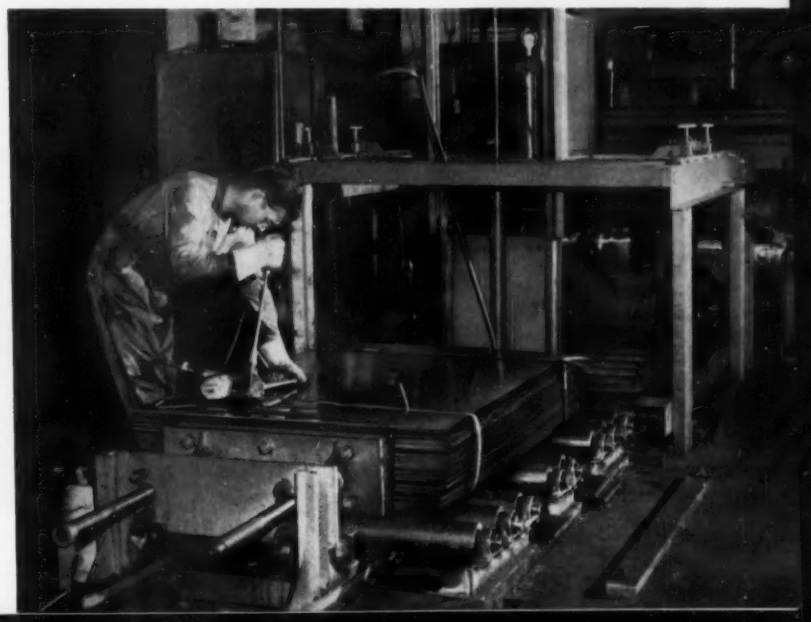


Fig. 5. After leaving the blasting machine, sheets pass through the oiler rolls and are conveyed to the stacker (background). The stacks are then banded ready for pick-up.

LATEST DEVELOPMENTS

Machine Tools, unit mechanisms, machine parts and

Baker Drilling Machines with Universal-Joint and Fixed-Center Heads

Completely redesigned hydraulic drilling equipment of Baker Bros., Inc., Toledo, Ohio, features interchangeability of universal-joint and fixed-center heads. Either type of head can be installed on the same machine. A head on a vertical machine will also fit a horizontal machine of corresponding size.

This flexibility provides the economy of adapting a universal-joint head to a required drilling pattern on a job in low production, and later, installing a fixed-center head when the same job or other jobs are in high production. Likewise, an isolated operation can be integrated in a transfer line by an easy shift of a head from a vertical machine to a horizontal machine.

In Fig. 1 is shown a basic vertical machine, and in Fig. 2, as equipped with a universal-joint head and box table. It is available in three way widths (12, 18, and 24 inches) and in two stroke lengths (18 and 27 inches). A wide range of standard box tables and power-indexing rotary tables is available. The 12-inch and 18-inch machines can also be furnished with a knee type adjustable table.

A coolant and chip trough around the base is of ample proportions to make cleaning easy and fast. There is a screen in the rear of the base separating the coolant sump from the chip trough. A limit switch controls the coolant system.

One of the basic horizontal machines appears in Fig. 3. These units are made in the same way widths as the vertical machines, and come in three stroke lengths (18, 27, and 40 inches). In Fig. 4, a standard fixed-center head has been installed.

The hydraulic and electrical controls, piping, and wiring for both the vertical and the horizontal machines are external, so they are readily maintained. Hydraulic power sources operating the saddles on which the heads are mounted are located on the floor near the machines, where they

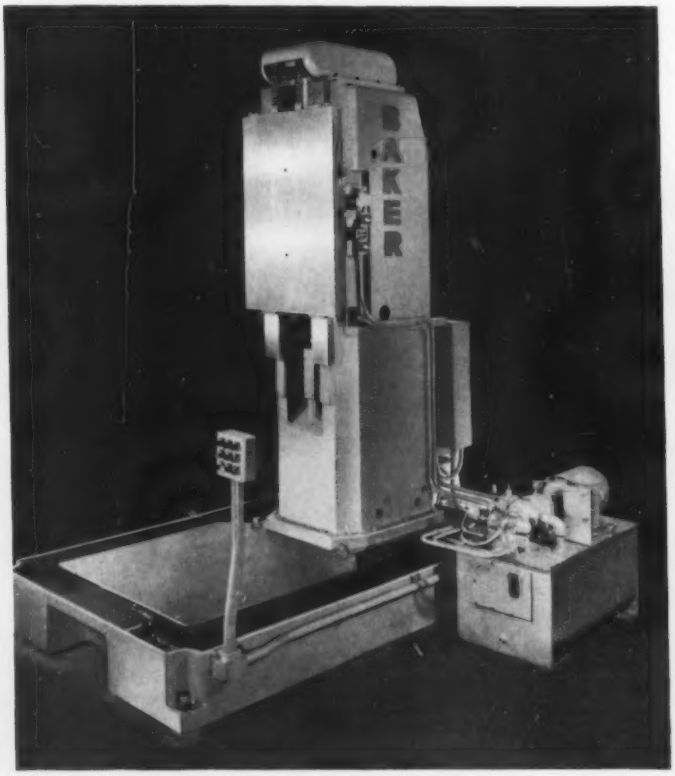
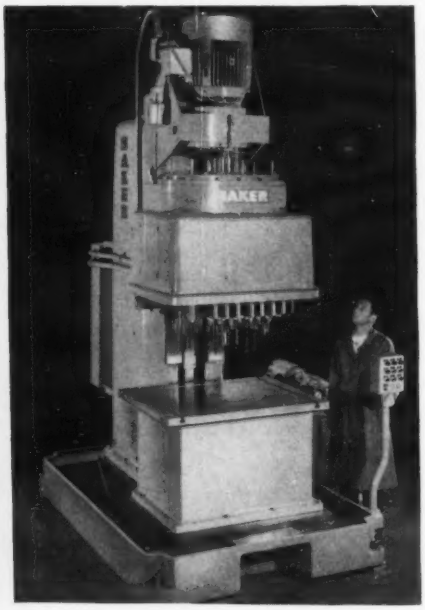


Fig. 1. (Left) Basic vertical machine before fitting with head and table

Fig. 2. (Below) For drilling a required pattern, this machine has a universal-joint head and box table



IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by Freeman C. Duston

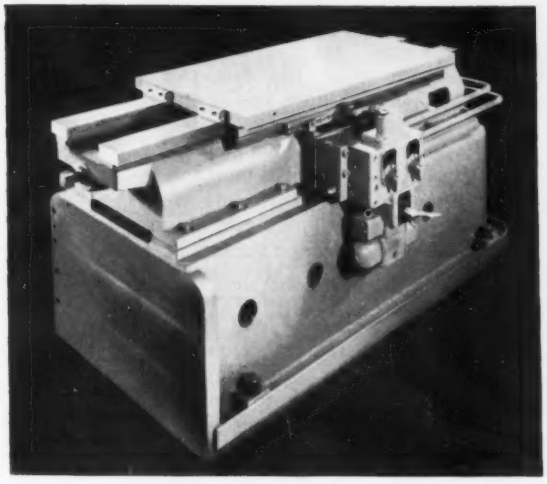


Fig. 3. Controls on side of machine are for setup, feed rate, and camming from traverse to feed

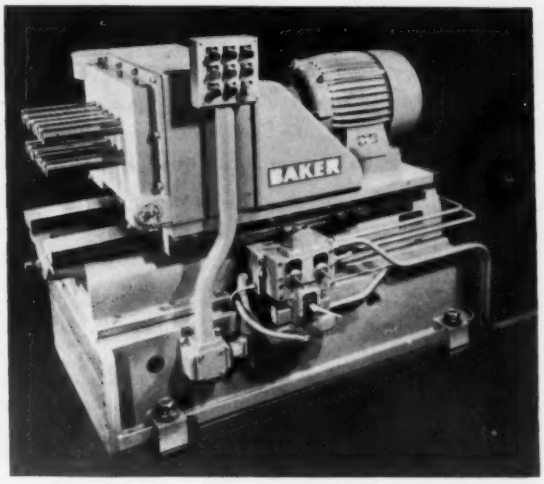


Fig. 4. This horizontal machine carries a fixed-center head for a specific hole pattern in high production

are accessible for oil replenishment and inspection.

Both vertical and horizontal machines come equipped with replaceable steel ways. In addition, the vertical machines can be supplied with integral cast-iron ways. For accuracy, tapered gibs are used to give a full bearing over the length of the saddle. A metering pump mounted on the machine lubricates the ways.

Four sizes of universal-joint heads are available for the 12-inch way machines, from a 16-inch round head with 1 1/2-inch joints and sixteen spindles, to a 14- by 22-inch rectangular head with 1-inch joints and twenty-four spindles. There are eight sizes for the 18-inch machine, from a 20-inch round head with 2-inch joints and twelve spindles, to an 18- by 48-inch rectangular head with 1-inch joints and sixty spindles. For the 24-inch machines, there are nine sizes, from a 26-inch round head with 2 1/2-inch joints and sixteen spindles to a 24- by 50-inch rectangular head with 1-inch joints and sixty spindles.

Above each universal-joint spindle (Fig. 5), there is a pin adjustable to high-speed, neutral, and low-speed positions. High-low speed ratio is 2 to 1. Change-gears are also provided.

A total of twenty-seven sizes of



Fig. 5. Pins above each universal-joint spindle give independent adjustment for high speed, neutral, and low speed. Unused spindles can be detached to reduce maintenance

fixed-center heads is available. These can be designed with a joint size and spindle layout to fit the work on hand. Of "watch-case" design, the entire drive mechanism, spindles, spindle bearings, driving gears, and idler gears can be removed from the housing as a complete unit. Both the universal-joint and fixed-center heads are lubricated from an externally mounted pump.

A single cylinder actuates the saddle, and is mounted between the ways. It can be easily removed without disturbing the saddle, ways, or head.

The standard cycle consists of a rapid traverse, coarse feed, fine feed, reverse, and stop. Special cycles can be arranged to include jump feed, back feed, or tapping. For safety, the machines are cammed mechanically from rapid traverse to feed, to prevent the possibility of tool damage in the event of electrical failure.

Circle Item 101 on postcard, page 193

Ex-Cell-O "Numeri-Trol" Profiling Machines

"Numeri-Trol" profiling machines, considered the first to perform three-dimensional machining under numerical control around the axis of the work, have been announced by the Ex-Cell-O Corporation, Detroit, Mich. These machines are equipped for both milling and grinding operations. They are also claimed to be the first numerically controlled machines in which provision is made for grinding-wheel dressing and compensation for the dressing operation.

The machines will produce such parts as cams, templates, airfoil contours, steam turbine buckets, and jet-engine blades. Parts having irregular and twisted forms can be machined without cams or special tooling. All instructions for the operations are recorded on tape. The length of time required to make the tape is dependent upon the complexity of the part. Making the tape, however, requires only a fraction of the time needed to do the same work on an operator-controlled machine equipped with conventional tooling.

The Ex-Cell-O Corporation does not manufacture the control equipment, but designs and builds the machines that can be operated from any high-performance, numerical-control system. Of the first two profiling machines, one is operated by a magnetic-tape system and electric servo motors, while the other uses punched tape and hydraulic servo motors. Also, it is the purpose of one machine to produce steam turbine buckets in relatively small lots. This unit will handle buckets in a wide range of sizes up to 60 inches long and 11 inches wide. The other machine is intended for producing cams, templates, and prototype jet-engine blades.

Some of the advantages of numerically controlled machines in handling work of this kind are as follows: Prototype parts are

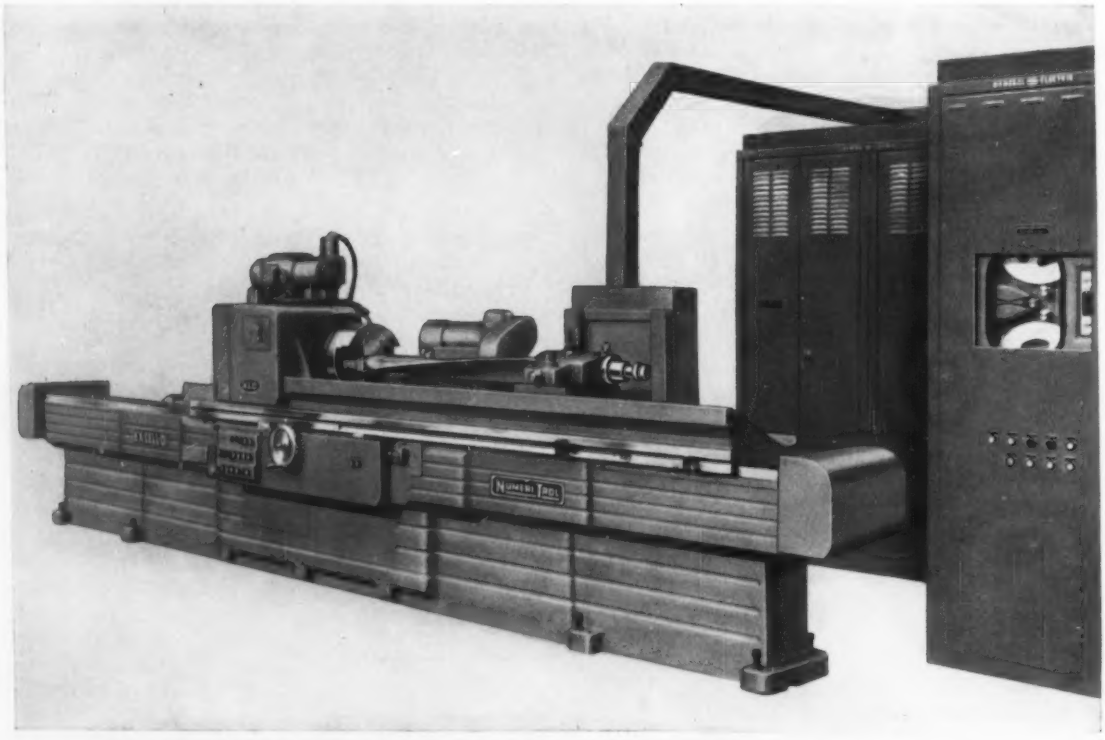


Fig. 1. Ex-Cell-O "Numeri-Trol" machine on which three-dimensional machining of complex forms with work rotation is accomplished by tape control

produced in a fraction of the time formerly required; tooling costs are practically eliminated on this type of work; change-overs are quickly accomplished (after the tapes are made, it is only necessary to simply insert proper tape, load work-piece, set machine at zero position, and start the machinery cycle); costly handling and storage of tooling is eliminated; rate of production is controlled by tape, no time being lost between various phases of work; human error in machine operation is eliminated; and consistent production and quality of work are assured. These advantages make tape-controlled machines especially adaptable for economical production of prototypes and small lots of parts that are difficult or impossible to machine on standard equipment without the use of costly special tooling.

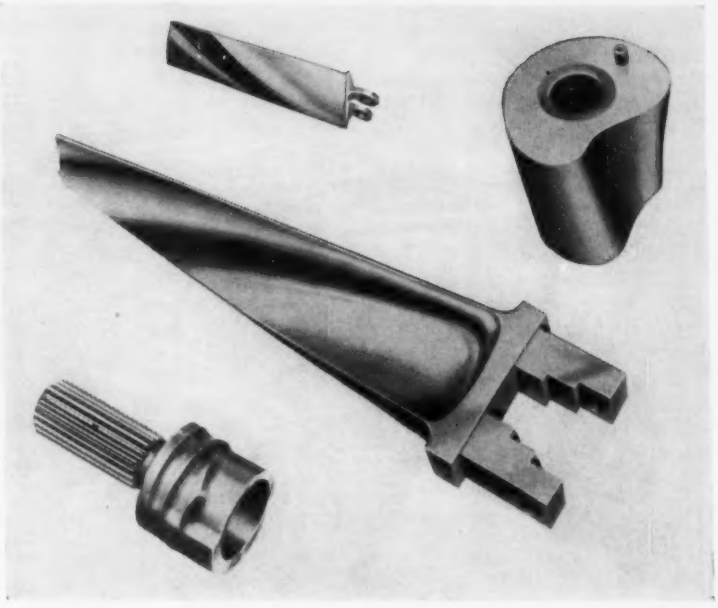


Fig. 2. Cams, steam-turbine buckets, and jet-engine blades that are typical of the forms that can be milled and ground on Ex-Cell-O Numeri-Trol machines

The Ex-Cell-O Numeri-Trol profiling machines are especially designed for numerical control. The cast base is generously ribbed for utmost rigidity. Leveling pads and jack-screws permit accurate leveling and alignment of the base on its heavy concrete foundation. Both work-table and cross-slide are actuated by pre-loaded, anti-friction lead-screw and nut assemblies that are ground on Ex-Cell-O thread grinders. These assemblies permit accurate control of table movements with a minimum of power. The pre-loaded lead-screw practically eliminates backlash that would be destructive to precision work in this type of machine.

The work-table casting, weighing more than a ton, moves on vee and flat ways. The base ways are hand-scraped to a master, as are the table ways. The table and base are then matched or fitted together. Finally, hardened-and-ground rollers in retainers are placed on the ways for the table to ride on. Thus supported, the table can be moved with a breakaway force of only 18 pounds. A pull of only 14 pounds will keep the table in motion.

The cross-slide is an aluminum casting designed to minimize weight, and thus reduce inertial forces. It moves on roller assemblies interposed between hardened and ground ways. The force required to start this slide in motion is only 14 pounds and a pull of 10 pounds will keep it moving. The cross-slide supports interchangeable milling and grinding assemblies. The milling unit consists of a spindle, a gear-reduction motor, and a silent-chain drive, all mounted on a base. Carbide-tipped, form-relieved milling cutters are used, the cutter diameter being selected for the work to be done.

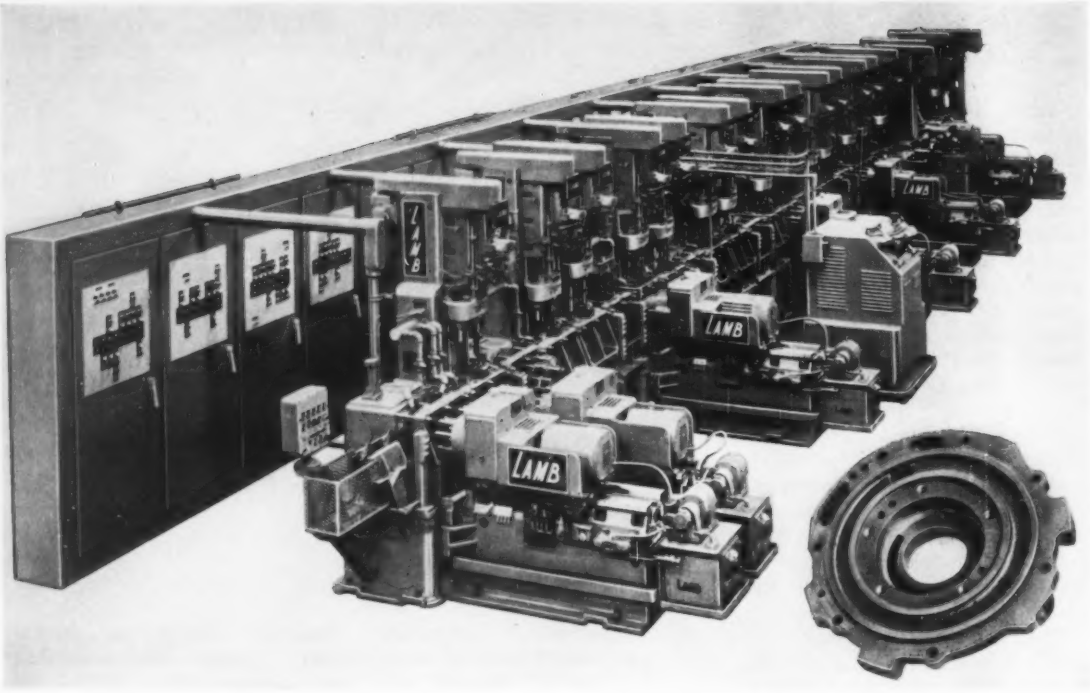
The grinding assembly has some ingenious features. It consists of an Ex-Cell-O precision-grinding spindle with its drive equipment and a hydraulically operated, swivel type diamond dresser, all assembled on a base. The spindle is mounted on a small slide that provides movement in an axial direction. The dresser bracket is rigidly mounted to the base. An elongated, cup type grinding wheel is dressed to a spherical shape of a definite radius which is maintained throughout the life of the wheel. This is necessary to generate the desired size and form on the work-piece.

The position of the grinding wheel in relation to the work is always maintained regardless of the dressing operation because the dresser does not move. Instead, the wheel-spindle moves toward the dresser. The dressing operation has the effect of an automatic sizing device, restoring the wheel to its original position in relation to the work. Thus, the amount dressed off the wheel is compensated for automatically.

The pause in the machining cycle, the withdrawal of the cross-slide for the dressing operation, and the frequency of dressing are controlled by the tape. The work is held either between centers or in some type of work-holding device. During the grinding, and in rotary milling operations, one motor drives the work-spindle. Through a train of gears, it also drives the lead-screw to give the desired feed per revolution.

Longitudinal milling is an alternate method whereby the work feeds lengthwise in relation to the milling cutter, then indexes and feeds back. Thus, feeding, and indexing continue until the work is rotated 360 degrees. For this operation a second motor drives the lead-screw, and at the end of each stroke, the first motor indexes the work-spindle.

Circle Item 102 on postcard, page 193



Transfer machine for processing pump bodies built by F. Jos. Lamb Co.

Automated Transfer Machine for Processing Pump Bodies

A thirty-one-station transfer machine, designed and built by F. Jos. Lamb Co., Detroit, Mich., has a capacity for processing 378 automatic-transmission pump bodies per hour. This equipment machines the part from five different angles and three positions. Practically every known method of machining holes, as well as plunge face-milling with multiple-blade cutters, is employed in handling this work. The machine exemplifies "building-block" unitized construction, affording complete ease of component rearrangement for production flexibility. The main base is a series of blocks. Each is of welded construction with machined, square, mounting faces for supporting fixtures and accessories and attaching wing-and-column base units. A chip-coolant chute and a recess for concealing piping and conduit are cast integral within each base block.

Wing bases support Lamb standard way type units which are used for heavy-thrust milling, drilling, and tapping operations. Plate type work-heads permit quick and easy change of hole patterns. Standard quill type, self-contained, hydraulic power units perform light-thrust operations. Each working station has a fixture with integral clamping. Consequently, each station is a self-sufficient machine built of interchangeable components. Quill units are mounted vertically on the fixtures and all wing units are horizontally mounted on the right side of the base. This arrangement provides maximum left side accessibility to fixtures, tools, and clamping machanism.

The transfer mechanism is of the walking-beam type. It has hardened part nests and incorporates harmonic deceleration. The machine also incorporates a new idea in probes. Removable probes require only one limit switch and can be replaced in seconds by lifting the retainer plate and sliding the probe out of its bushings. Additional features include manifolding of hydraulic accessories, completely centralized automatic lubrication system, individual control buttons at all working stations, and master electrical push-button control at the loading station that pivots to allow right or left side operator position.

A schematic light panel, visible from operator position, indicates machine function or malfunction. The machine incorporates use of new control elements that permit circuit changes and maintenance with plug-in connectors.

Circle Item 103 on postcard, page 193

Semi-Automatic Brinell Hardness Tester

A high-production, Brinell hardness tester designed to make accurately located tests has been announced by Steel City Testing Machines, Inc., Detroit, Mich. This machine must accurately position the work-piece before it can make the test. A precision limit switch located in the table fixture must be depressed by the part before the knee-actuated cycle switch becomes energized. The cycle time for the test is only two seconds.

Colored lights on the machine indicate the relative hardness of the part. When a part is too hard, the ball will not penetrate deeply

enough, and the yellow light will flash. If the ball penetrates too far, the material is too soft and the red light flashes. Acceptable parts are indicated by a green light. The machine can distinguish a difference of 0.1 mm in the diameter of the impression. Limits for the Brinell range to be indicated by the lights are selected by using pieces of known hardness.

Only after the limit switch and cycle switch have been actuated, will the tester apply the full hydraulic load (which is adjustable), flash the hardness signal, and withdraw the penetrator. The penetrator ram has a maximum travel of 1 inch. A gage on the front of the machine is periodically used to check the applied load.

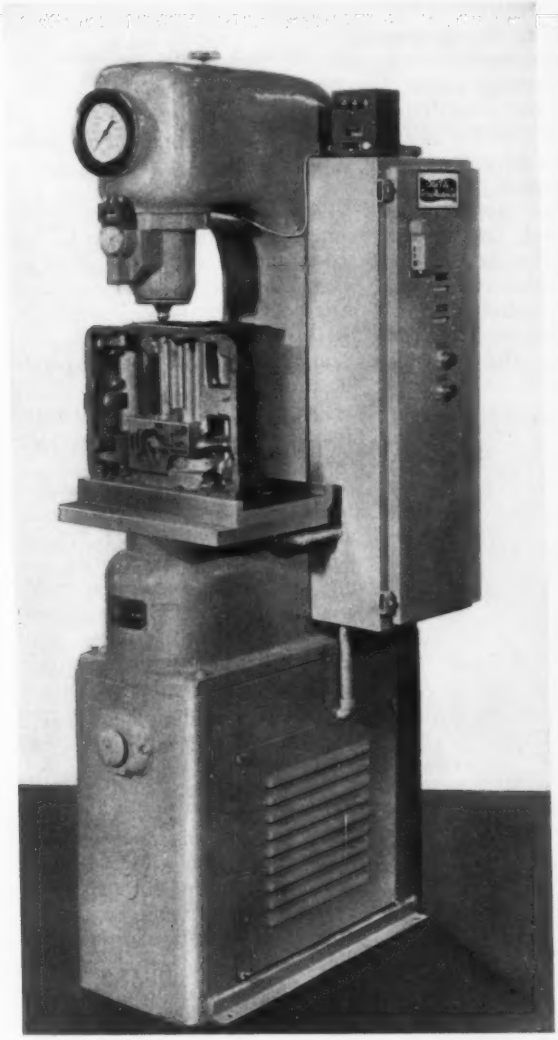
The throat depth of the machine is 10 inches; the maximum vertical opening, 14 inches; and the applied load capacity, from 500 to 3000 kg. The tester will accommodate a wide range of parts by using different locators.

Circle Item 104 on postcard, page 193

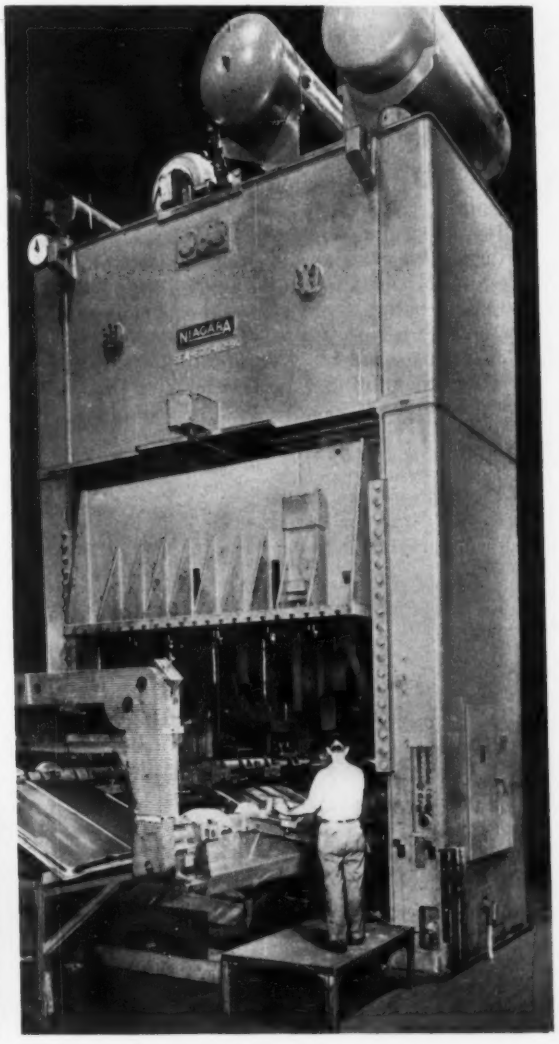
Niagara Presses for Large, Heavy-Tonnage Work

A line of Series SE straight-presses, modernized to handle a variety of large, heavy-tonnage drawing, punching and blanking work, has been announced by the Niagara Machine & Tool Works, Buffalo, N. Y. The line includes 130 models of one-, two-, and four-point suspension presses in increased capacities, ranging from 100 through 1250 tons. All machines in this line can be equipped for automation.

An outstanding feature of these presses is the Niagara crankless eccentric-gear drive which has been developed to deliver greater torque with less deflection than was possible with the types of construction previously employed.



High-production semi-automatic Brinell hardness tester shown by Steel City Testing Machines, Inc.



Straight-side, eccentric-geared press for heavy-tonnage work built by Niagara Machine & Tool Works

The eccentric is an integral part of the main gear which rotates on a stationary pin rigidly supported in the crown. The pin, serving merely as a pivot, carries no torsional load and relatively little bending load.

Rugged, all-steel frames of four-piece construction are designed to assure maximum accuracy and prolonged die life. The low-inertia, quill-mounted, pneumatic friction clutch serves to reduce heat and wear because most of its weight continues to rotate with the flywheel. An automatic, circulating oil system incorporated in the design keeps the gears and bearing surfaces properly lubricated.

All air, electrical, and circulating-oil controls are enclosed in the uprights. The driving assembly is housed in the crown, and there is no exposed, overhanging flywheel, clutch, or other mechanism to cut off light, throw grease, or take up floor space unnecessarily. Operating controls of the latest type are conveniently arranged on a master panel.

Circle Item 105 on postcard, page 193

"Roto-Matic" Transfer Machine

A "Roto-Matic" transfer machine for chamfering both sides of both ends of axle tie-rods has been announced by the Davis & Thompson Co., Milwaukee, Wis. The work is loaded by hand on the conveyor chain, which hydraulically indexes through successive stations, including the unloading station. At the first station a probing operation is performed to make sure that the holes have been drilled through the work before it reaches the first chamfering station.

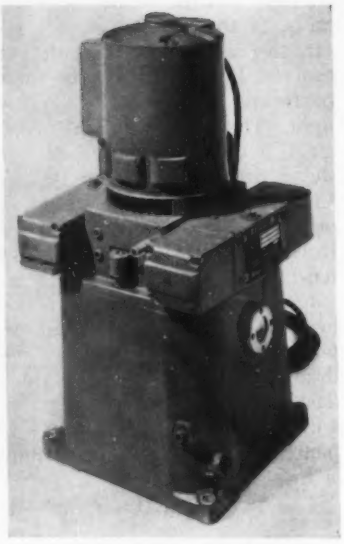
The second and third stations perform chamfering operations on opposite ends of the workpiece. These operations are performed simultaneously on two pieces, the stations being staggered so that work is done only on one end of a piece at a time.

Following up the chamfering operations on one side the pieces are transferred to a turnover station. They then pass on to the next two stations where the other sides are chamfered. The finished parts are then discharged. Cycling of the machine is hydraulically and air controlled. Production is at the rate of 666 tie-rods per hour. The machine weighs 6600 pounds.

Circle Item 106 on postcard, page 193



"Roto-Matic" transfer machine equipped to process axle tie-rods



Brown & Sharpe "Circuitpak" hydraulic power unit

Brown & Sharpe Hydraulic Power Unit

A low-cost, hydraulic power unit, called the "Circuitpak," has been announced by the Hydraulics Division of the Brown & Sharpe Mfg. Co., Providence, R. I. This compactly assembled unit with electric motor, hydraulic (oil) pump, valves, and oil reservoir is manifold-circuited for direct connection to the cylinder lines.

Four pump capacities ranging from 0.8 to 5 gallons per minute are available with 1-, 1 1/2- or 2-hp capacitor-start electric motors, and up to four solenoid-operated four-way valves. Reservoir capacity is 2 gallons, with nickel-tube heat exchanger cast in housing for cooling oil. Operation is at the rate of 3600 rpm with pressures running as high as 1000 psi.

Circuitpaks may be applied with cylinders of all sizes to provide power for spot-welding, vise-clamping, indexing, cutting, molding, riveting, lifting, pushing, feeding, traversing, and many other machine and materials-handling operations. Unitary design is especially adaptable for conversion of manually or mechanically operated production equipment to hydraulic automation.

Circle Item 107 on postcard, page 193

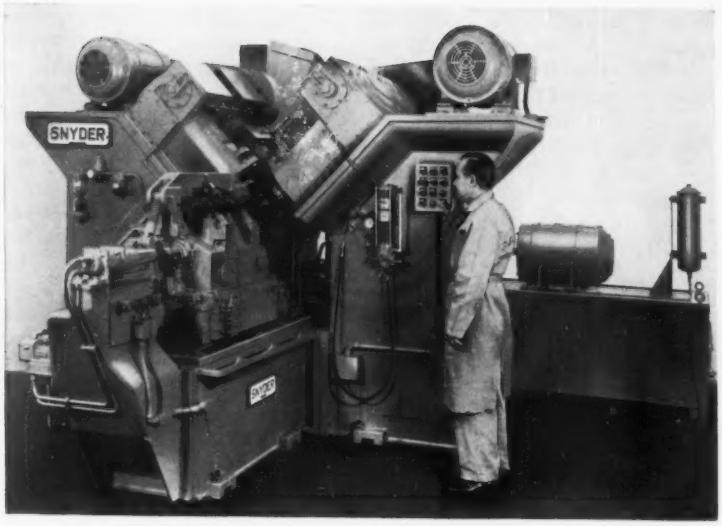


Fig. 1. The first machine in Snyder low-production manifold milling battery. This unit rough- and finish-mills the joint faces in a single pass

Snyder Special Machines for Processing Intake Manifolds

Three special milling and drilling machines that provide an economical means for producing automotive intake manifolds in low-production quantities have been designed and built by the Snyder Tool & Engineering Co., Detroit, Mich. The production unit consists of a line-index type machine for rough- and finish-milling the manifold joint faces, a special drilling machine for drilling and reaming location holes, and a special milling machine that mills the water flange and carburetor mounting pad.

Each machine is hydraulically operated and electrically controlled. One operator runs each unit and performs loading, push-button cycle, and unloading operations. Maximum economy in machine cost is achieved by eliminating automation devices between the three machines in the production unit. The machines are powered by hydraulic units.

One intake manifold is loaded upside down is a line-index fixture that is fed under a pair of angular milling units and returned to the initial position for unloading. An air-powered impact wrench mounted on the machine engages a socket in the fixture to perform the push-button-controlled clamping and unclamping functions.

Each of the angular milling heads has one rough- and one finish-milling cutter under which the part passes during the machining cycle. These heads are mounted on welded-steel columns, and each pair is powered by a 15-hp motor. The production rate for this machine, Fig. 1, is fifty-three pieces per hour at 100 per cent efficiency.

After the joint faces are milled, the manifold is placed right-side up on these faces on slide rails, and hydraulically clamped in the second machine in a fixed position for the drilling operation. Four-spindle drilling heads on each side of the machine drill the part from the bottom in angular locations. Two of the spindles in one of the heads utilize combination drilling and reaming tools to provide reamed manufacturing holes for subsequent operations. After drilling, the part is slid through the machine on rails to the opposite side where it is unloaded on a roller type conveyor. The production rate for this operation (not illustrated) is 102 pieces per hour at 100 per cent efficiency.

With the joint faces milled and provided with locating holes, the manifold is placed right-side up on rails in the third machine, Fig. 2, and slid into machining position where it is hydraulically clamped for the milling of the water flange and carburetor-pad surfaces. Two separate heads perform these machining functions. The water flange is milled by a cutter that is traversed across the



Fig. 2. Third machine in Snyder manifold battery. This view shows part clamped in position on joint faces for milling water flange and carburetor pad

end of the part, while the carburetor pad is milled by a cutter that travels in an angular path with respect to the plane of the joint faces.

The pad milling head is powered by a 15-hp motor. Since the head overhangs the part, it is provided with support on the opposite end by a guide that travels in a slide during the machining operation. A spacer type mounting is provided for the pad milling cutter to permit the machining of selected pad heights for different manifolds. The production rate for this machine is fifty-three pieces per hour at 100 per cent efficiency.

Circle Item 108 on postcard, page 193

Cincinnati Milling Machine with Tracing Control

A Contourmaster milling machine, equipped for three-dimensional, hand-guided hydraulic tracer-controlled milling, was recently announced by the Cincinnati Milling Machine Co., Cincinnati, Ohio. This equipment, designated 1C, retains the basic advantages and design characteristics of the 1A and 1B styles introduced at the last Machine Tool Show. The principal difference is in the type of tracing equipment: vertical, automatic depth control to the spindle for the 1A and 1B styles, and 3-D hand-guided hydraulic tracing for the 1C style.

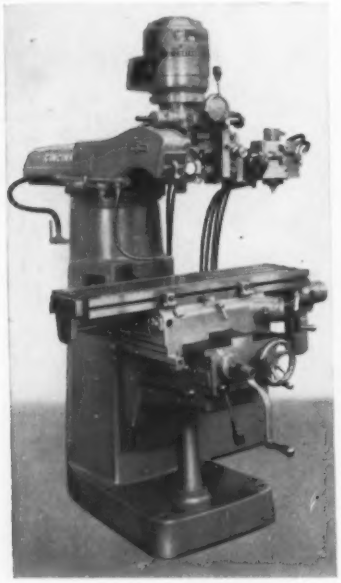
The new 3-D unit controls the direction of traverse of the table and saddle for 360-degree horizontal profiling, and the vertical movement of the spindle quill for vertical profiling. Deflection of the stylus results in a corresponding movement of the table, saddle, and spindle quill separately or in unison. Hydraulic motors perform the actual work of traversing the saddle and table units through feed-screws that engage anti-friction nuts. With this machine, 360-degree horizontal feed rates, within the limit fixed by a knurled adjusting dial above the tracer finger, are controlled by the amount of tracer finger displacement. Maximum feed is 25 inches per minute.

When the tracing unit and quill are in the fully retracted position, a rapid-traverse rate of 50 inches per minute is available for positioning the table and saddle. Of course, the conventional handwheel controls can also be used for positioning. A vertical-feed adjusting dial, also above the tracer finger, determines the maximum "down" feed rate of the spindle.

Four distinct combinations of feed movements are available on the new Cincinnati 1C Contourmaster. First, all three movements can be "active" for complete three-dimensional control; second, vertical movements can be "blocked out" for 360-degree profile milling in a horizontal plane; third, cross-feed may be "blocked out" for depth-control milling, using vertical feed and table feed; and fourth, table feed can be "blocked out" for depth control milling, using vertical feed and cross feed. Power feed in a straight line, using the table or cross traverse, can also be engaged without constant hand deflection of the tracer finger. The device for this feature, mounted on top of the 3-D unit, holds the tracer finger in any desired deflected position.

In one setting, the full 22-inch table travel and 10-inch cross travel can be used for 360-degree, hand-guided, profile-milling cuts. Ram mounting of the spindle carrier permits the milling of work wider than 10 inches in two settings. Vertical range of the spindle quill is 3 1/2 inches. A 1-hp motor drives the spindle. There are eight speeds ranging from 215 to 5650 rpm.

Circle Item 109 on postcard, page 193



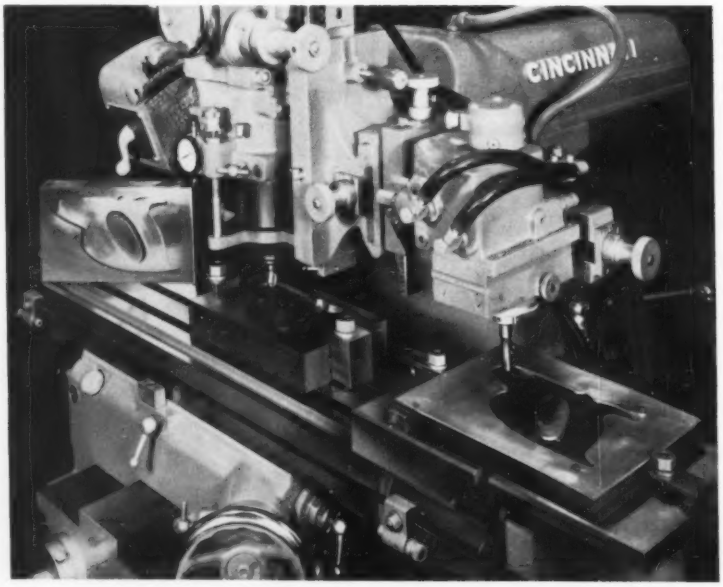


Fig. 1. (Left) Cincinnati Contourmaster milling machine. Fig. 2. (Right) Setup for milling a saw-handle mold on the Cincinnati No. 1C Contourmaster. A finished mold is shown at the left



Air-cooled engine-driven Heliwelder announced by Air Reduction Sales Co.



Red Ring cluster-gear automatic loader that provides quick-change gaging setups

Air-Cooled Engine-Driven Welders

The Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City, has brought out air-cooled, engine-driven Heliwelders in three types—one 250-ampere, direct-current, and two 300-ampere, alternating-current direct-current machines. All machines provide 115- to 230-volt, 10-kilowatt, single-phase, 60-cycle power when operated as power plants. They have 115-volt, direct-current auxiliary power available for operating lights and power tools while welding.

The 250-ampere, direct-current machine is designed for general-purpose construction and maintenance welding in the field, especially in pipeline work. The 300-ampere, alternating-current, direct-current machine is a remote-area welder and power plant for alternating-current welding and direct-current reverse, or direct-current straight polarity welding current. The 300-ampere, alternating-current direct-current Heliwelder is for field operations where aluminum or magnesium structural welding is involved. Automatic inert-gas control panel with solenoid valve and post flow timer is standard equipment.

Circle Item 110 on postcard, page 193

Red Ring Automatic Loader for Gear-Shaving Machine

A Red Ring automatic loader for handling cluster type gears on rotary gear-shaving machines is announced by the National Broach & Machine Co., Detroit, Mich. This versatile loader will handle four different setups on a single part.

In shaving different gears of a cluster on a single shaving machine equipped with the automatic loader, there are five variables to consider: shaving cutter; cutter and work center distance; head and tailstock axial positioning; axial positioning of the loader; and size gaging of the gear to be shaved. Cutter changes, center distance adjustments, and axial positioning of machine head and tailstocks, and the loader proper are simply and easily accomplished. The provision for quick-change size-gaging flexibility within the loader is a more complex problem that is solved by this equipment.

The loader is of the rocker type in which an air cylinder powers a rocker-arm mechanism that removes gears, one at a time, from an input magazine feed and deposits them in the shaving position where air-powered head and tailstocks position them for the shaving operation. A finish-shaved gear is removed from the shaving position and placed in an exit chute while the next gear is loaded into the shaving position. The input size-gaging function in the loader is provided by passing the particular gear to be shaved between a pair of master gears before it enters the storage magazine.

To provide quick setup gaging flexibility, the upper master gears for the four gears on the cluster are mounted on a single shaft. This upper shaft has a knurled knob that is turned manually to feed the cluster into the magazine. The gears are fixed to the shaft by means of cone-point screws. The other four master gears are mounted on another shaft under the cluster. These gears "free-wheel" on the shaft and are positioned axially by spring poppets.

To make a gaging setup for a particular gear, the upper master is moved axially into the predetermined location and locked with the cone-point screw. The lower master is then moved into the proper poppet position. All other master gears are in location where they clear the remaining gears of the cluster.

Circle Item 111 on postcard, page 193

Improved Automatic Assembly Machine

An improved auto-positioner, announced by Dixon Automatic Tool, Inc., Rockford, Ill., consists essentially of the Dixon automatic parts-positioning head and a newly developed parts feeder, which positively guides the part into place. Both units are mounted upon a dual column for compactness, rigidity, and convenient adjustment. They are actuated by compressed air. An important feature of the feeder is that it requires no auxiliary motor or vibrator. No curved tracks are used and it is not necessary to depend on gravity for placing the part in the chuck.

Designed to handle parts ranging in size from 1/16 inch to 2 inches, the positioner automatically and positively transfers the parts from feeder to fixture at speeds up to 6000 per hour. An important feature of the positioner head is its built-in sensing mechanism, which causes the machine to stop if a part is missing or malformed. The unit stops with the ram in the forward position, making it easy to locate the source of trouble.

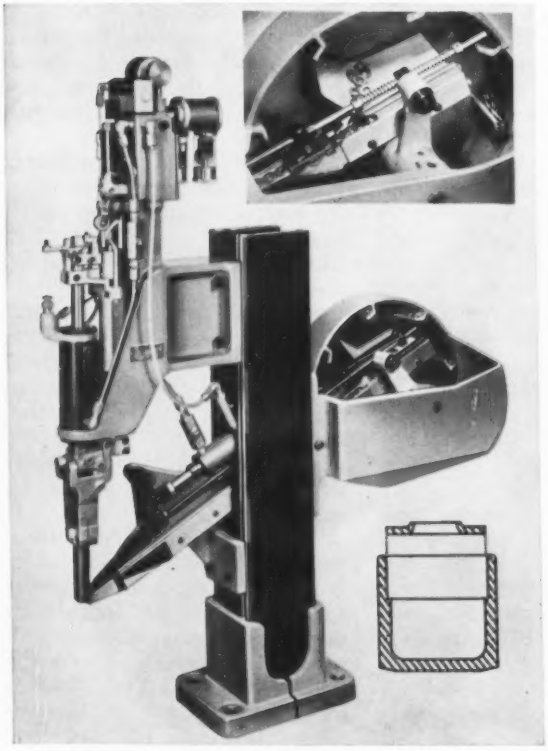
The illustration shows the fully automatic auto-positioner tooled to feed and place a 0.455-inch diameter formed washer into a cup having 0.001-inch clearance, as indicated by the cross-section view in the lower right corner. The inset in the upper right corner shows the feeder mechanism as furnished for the job. Drum lugs deposit washers upon the specially formed loading tray, from which they fall to the feed track, to travel with the formed side down. When reversed, they are automatically guided back to the hopper.

Circle Item 112 on postcard, page 193

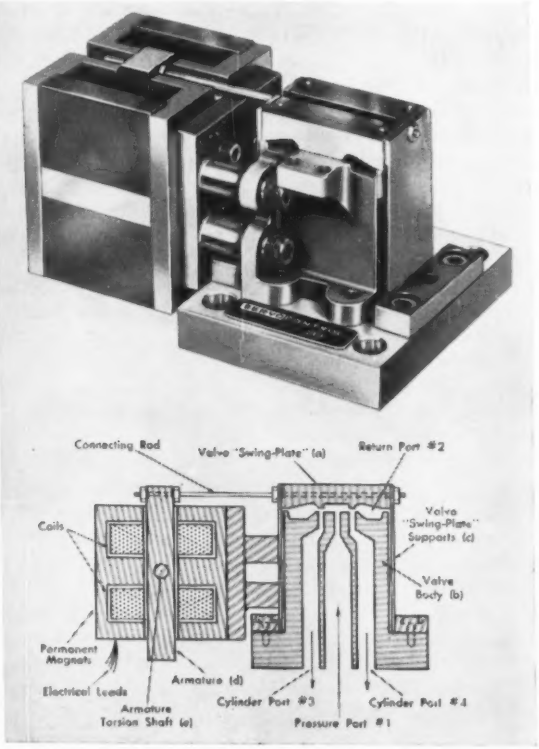
Oilgear Electrohydraulic Servocontrol Valve

A servo valve for controlling fluid power on brake and forming presses, metal expanders and shrinkers, flying cut-off saws, grinding and transfer machines, and other automatic metalworking machinery has just been announced by the Oilgear Co., Milwaukee, Wis. This single-stage, electrohydraulic three- and four-way servo valve contains only two moving parts: a torque-motor armature and a "Swing-Plate." There is no metal-to-metal contact between the "Swing-Plate" and valve body. This frictionless feature provides for higher sensitivity and fast response to minute signals. It virtually eliminates sticking, scoring, and jamming.

Clearances and port seal sizes can be varied to suit the application and the type and amount of fluid handled. Sharp, long, rectangular chambers and lands linearize valve characteristics, so that the flow rate is essentially a linear function of valve displacement, supplying high fluid-power gain with minute "Swing-Plate" movement. Hardened stainless-steel construction assures reliable operation well in excess of a hundred million cycles, even with non-lubricating fluids.



Dixon fully automatic auto-positioner for feeding and placing washer in cup



Oilgear Servocontrol valve with enclosure removed, and cross-section view of valve

The new Oilgear Servocontrol components applied to controls on Oilgear pumps and transmissions are designed to provide greater system accuracy and resolution. Functions easily attained with the Oilgear Servocontrol open and closed-loop systems include precision and high-response speed control, from zero to maximum revolutions per minute in either direction through remote control stations or switches. The system also provides for positive, high-response and follow-up position control through remote command units. Output motions or speeds with closed-loop systems will remain nearly constant with accuracies from 0.1 to 1.5 per cent, and with resolution down to 0.05 per cent.

Circle Item 113 on postcard, page 193

"Rol-Form" Die Designed to Eliminate Work Marking

A press brake die with roll inserts which eliminate work marking and reduce die setup and change-over time has been introduced by the O'Neil-Irwin Mfg. Co., Lake City, Minn. This die can be used in any mechanical or hydraulic press brake or punch press. It is called the Di-Acro "Rol-Form," and is particularly useful where polished, painted, and bright-finish metals are being formed, as it eliminates work marking on those materials.

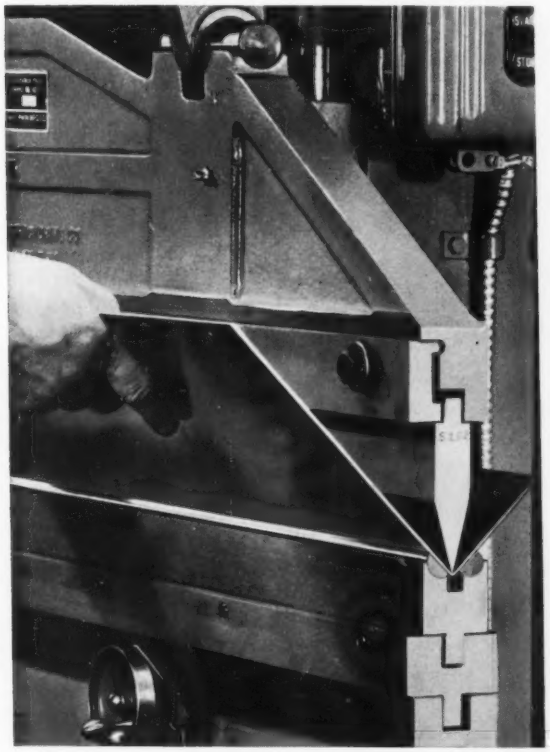
The dies differ from conventional V-dies in that the die-block houses two hardened and ground, half-round inserts which roll up and toward the opening in the die-block as the mating die enters the material to be formed. It is the rolling action of these inserts that does away with work marking. After each operation, a compression spring returns the roll inserts to a flat position, ready for the next bend.

Four standard styles of the Rol-Form dies with half-round inserts varying in size from 1/4 to 1 inch are available. The larger the half-round insert, the greater the material capacity. Using a 60-degree punch or upper die and one Rol-Form die, a range of material thicknesses can be covered that would ordinarily require several V-die setups and change-overs. The bed or ram of the press must be adjusted to accommodate the varying thicknesses of material to be formed. This adjustment also controls the degree of bend. Maximum degree of bend which can be formed with the Rol-Form die in any one material is 60 degrees. Any material from 0.005 to 1/8 inch thick can be formed without marking by these dies which are available in standard lengths up to 12 feet.

Circle Item 114 on postcard, page 193

P & W Lead Tester for Checking Threads

A lead tester designed to check the lead of straight or taper threads, internal or external threads, and taper of threads or cylinders has been announced by the Pratt & Whitney Co., Inc., West Hartford, Conn. This Model A electromechanical, universal lead tester is intended primarily for use in inspection rooms and



Di-Acro "Rol-Form" die for forming polished and painted material without work marking



Lead tester for checking external and internal threads shown by Pratt & Whitney Co., Inc.

gage laboratories. It is a high-precision gaging machine that can be used to check internal threads ranging from 1 1/4 to 16 inches in diameter, and external threads from 0 to 16 inches in diameter, on work as heavy as 500 pounds.

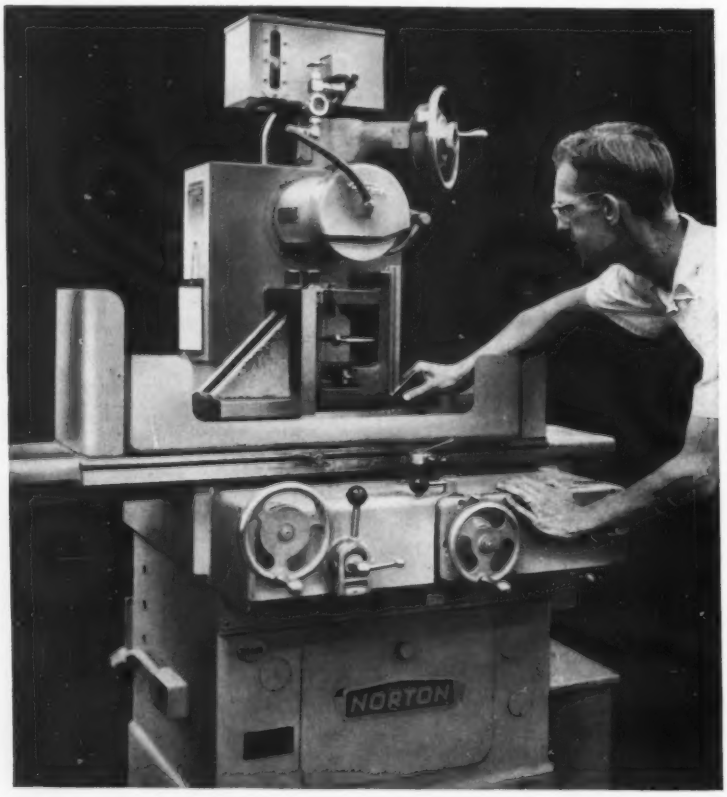
The device was especially designed to meet the demand for checking the lead and taper of API gages, which were often too large or too heavy for conventional methods of checking between centers or on V-blocks. Because of its universal features and extra capacity, this lead tester is ideal for checking all types of lead on thread gages and precision products.

Direct readings are made to 0.00002 inch for lead, and to 0.0001 inch for taper, by means of the well-known Electrolimit gaging principle incorporated in the gaging machine. In checking threads the zero reading is established by Hoke gage-blocks. It is then compared to the position of a ball point in the thread. The variation from zero is indicated on either the lead or taper Electrolimit scales, or on both, depending upon the elements being checked. Interchangeable gaging spindles and ball points are provided to check a full range of thread pitches.

Circle Item 115 on postcard, page 193

Norton Hydraulic Surface Grinder

The Norton Co., Worcester, Mass., has announced a 6- by 18-inch Type S-3 hydraulic surface grinder. An outstanding feature of this machine is a substantial increase in table speed which is said to reduce grinding time as much as 50 per cent over similar machines employing conventional feeds. The maximum table traverse speed of the new machine is 125 feet per minute. This is believed to be the fastest available on any surface grinder of similar capacity. It is claimed that in addition to reducing grinding time, the high maximum table traverse speed reduces burning, checking, and cracking of the work, particularly when grinding heat-sensitive steels.



Norton hydraulic surface grinder set up in the manufacturer's own toolroom for reconditioning a jig

Another feature is the machine's capacity for grinding a work-piece as high as 15 inches above the work-table with a standard 8-inch diameter grinding wheel. Other features include the two, hand-scraped flat ways of the base, which are made long and wide to give minimum bearing pressure per square inch, and hence insure long wear. The straightest possible cross-tracking of the saddle is assured by means of a guide rail and pre-loaded ball-bearing roller construction. This feature is particularly important in grinding square shoulders.

The accurate, hydraulic cross-feed movement at each table reversal is easily set or adjusted by a graduated dial type knob. A two-speed vertical feed handwheel provides rapid movement for positioning, and a fine feed, graduated in increments of 0.0001 inch, for precision feeding.

Setting up the work is further simplified by the centered reversing lever which permits the operator to line up the table dogs with the ends of the work. The table dogs themselves are set with finger pressure.

Finger-operated latches at the ends of the sliding table disengage the hydraulic cylinder to permit easy manual operation of the table. The table traverse handwheel is interlocked with the hydraulic start-stop lever to prevent rotation of the handwheel during hydraulic powered motion.

Optional equipment available with this machine includes: a 9-inch-per-minute, vertical power positioning unit, magnetic or electric chucks with all controls; dust-collection unit; integral motor spindle; and construction to JIC electrical standards. The machine can be arranged to employ wet grinding, coolant through the wheel, and electrolytic assist.

Circle Item 116 on postcard, page 193



Drilling and tapping machine added to line manufactured by Zagar, Inc.

Zagar Air-Oil Machines for Drilling and Tapping

A 22-inch air-oil-feed drilling machine has been added to the line of drilling equipment made by Zagar, Inc., Cleveland, Ohio. This machine will accommodate more and larger drills than the 14-inch machine previously brought out. It will also handle larger and heavier work, as well as a greater variety of materials.

The rugged, sturdy base is cast semi-steel, and contains all components, piping, and control linkage necessary to operate the machine. Capacity of this unit can be rated in three categories: thrust, torque, and ram movement. Thrust capacity is 2000 pounds with compressed air at 80 psi fed into the head end of a 6-inch cylinder. Torque capacity is ample for the installation of a 215 frame motor. This can be 5 hp at 3500 rpm; 3 hp at 1750 rpm; 2 hp at 1160 rpm; or 1 1/2 hp at 870 rpm. Ram movement has controlled or slow feed that can be adjusted from zero to a full 6 inches. Adjustable stops can be set to use any total length of stroke desired. The only control needed is a switch to start and stop the motor. All others are mechanical controls built into the machine.

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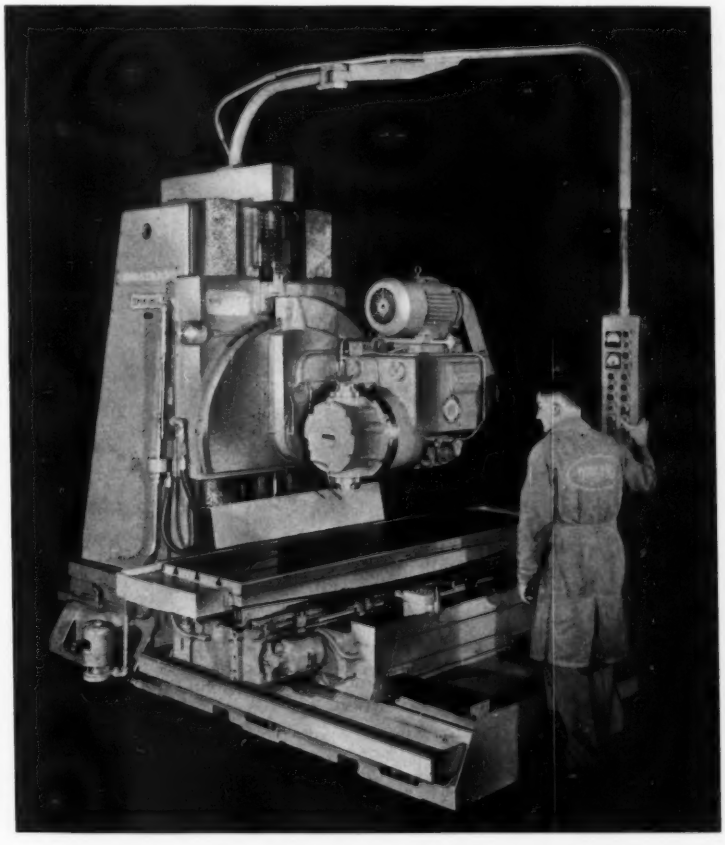
Sundstrand Omnimil for Precision Milling at Any Angle

The Sundstrand Machine Tool Co., Rockford, Ill., has brought out an Omnimil developed to combine the rigidity of a heavy-duty milling machine with the range of a boring mill and the versatility of an all-angle head. The double-spindle head can be adjusted to any angle, thus minimizing the amount of work-handling necessary when milling a work-piece requiring the machining of surfaces in a number of planes.

This machine has the capacity to take sizable cuts with its 15-hp, double-spindle head. The low-speed spindle for ferrous material has a speed range of 25 to 400 rpm, and the high-speed spindle for machining non-ferrous materials has a speed range of from 250 to 4000 rpm. Both spindles have quick speed changes.

Among the operations that are readily handled on this Omnimil are: angular, cross-, end-, and slab-milling, drilling, and boring. Power feed rates are infinitely variable between 1/2 inch and 200 inches per minute for longitudinal and transverse feed, and 1/4 inch to 100 inches per minute for vertical feed. Outstanding accuracy in setup is provided by pendent control that permits positioning control of less than 0.001 inch.

The center section of the head carries the motor and transmission gearing. A 90-degree circular motion that permits positioning the spindles in any angle from horizontal to vertical is power-positioned and hydraulically locked. Positioning accuracy is provided by the use of vernier scales. The center section housing the transmission provides sufficient bulk and rigidity to absorb cutter vibration and prevent deflection during the heaviest of cuts. The



Over-all view of Sundstrand Machine Tool Co.'s new Omnimil

front section housing the two cutter spindles is provided with 360-degree manual adjustment.

The pendent is pivot-mounted so that the operator can control all machine functions from the most convenient position for the job being performed. Because the cutter can be fed to the work, loading and unloading are always at a standard height, and all cuts can be taken close to normal eye level. The saddle and table are designed to provide ample support for heavy work.

Circle Item 118 on postcard, page 193

Elox Electro-Chemical Machine

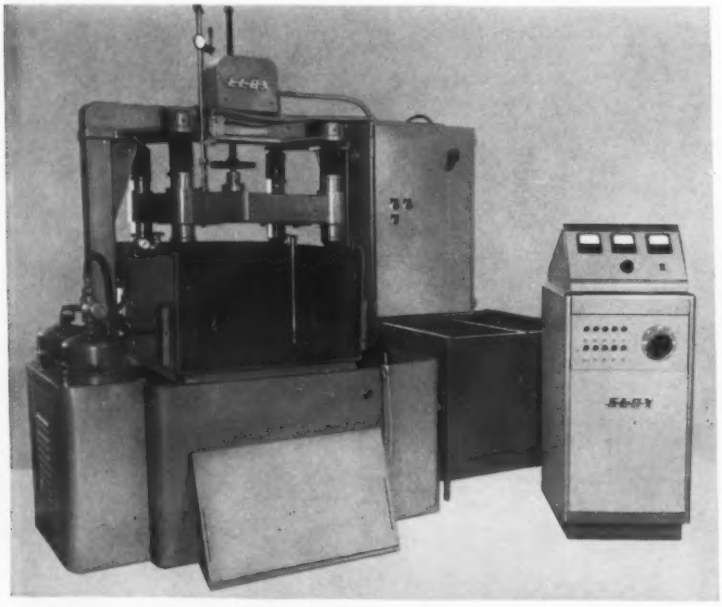
The Research Division of the Elox Corporation, Royal Oak, Mich., has announced the development of a new process designated "Electro-Chemical Machining" (ECM). With this equipment, parts can be electronically machined completely from start to finish. Its capacity for rapid metal removal has proved advantageous on large-scale die work in the automotive and aircraft industries.

The process consists of using an electrode similar to that employed in electrical-discharge machining, with both electrode and work-piece submerged in a saline solution. Metal is removed by an electro-chemical action controlled by a highly sensitive servo-feed system that automatically advances the electrode into the work-piece as the machining progresses. The currents that can be used are not restricted to any particular range.

Metal-removal rates of the machines are listed in ranges of 500 to 50,000 amperes. Typical metal-removal rates using a 5000-ampere power supply rating would be 30 cubic inches per hour with a minimum electrode area of 100 square inches. Using a 50,000-ampere power supply rating, metal-removal rates are 300 cubic inches per hour with a minimum electrode area of 1000 square inches.

In addition to the extremely high metal-removal rates, it is claimed that the machines offer many other unique advantages. The cost per cubic inch of metal removed is low, since the electrode can be reused many times without appreciable wear. The electrode can be made of any conductive material such as lead, tin, or solder to keep the cost low.

Circle Item 119 on postcard, page 193



Machine brought out by the Elox Corporation for application of its newly developed "Electro-Chemical Machining"



Stocker & Yale Comparator

Dual-Image Comparator for Checking Small Assemblies

A small, dual-image projector for use in checking runout or worm-and-disc assemblies for watt-hour meters has been announced by Stocker & Yale, Inc., Marblehead, Mass. Magnifications for this application are alike for both images. Screen size is purposely reduced to include only the areas or details to be checked. Fixture equipment is relatively simple. Screen and fixture adjustments are provided so that setting to a master or to suit changes in specifications may be accommodated. The optical systems are designed for checking the adjustments of assembled parts in two planes and are pre-set by the manufacturer. The instrument is compact and convenient to use in any location, since it occupies only about 1 1/2 square feet of bench space.

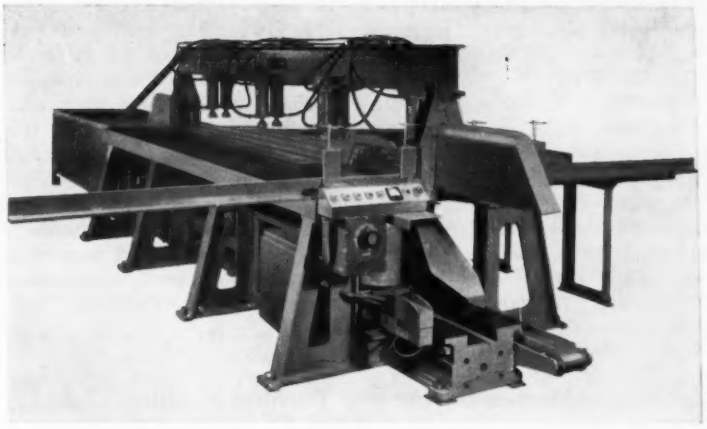
Variations of the dual-image projector are almost unlimited. Optical systems may be of different magnifications and of differing focal lengths. The optics may be parallel projection paths, as shown, or intersecting paths. Screens to accommodate various magnifications and part sizes range from 3 by 3 inches square to 20 inches in diameter, with separate screens for each view or both images appearing on a single screen. Triple systems for checking three coordinates or features at one time, while not common, are nevertheless quite possible and practical for certain applications.

Circle Item 120 on postcard, page 193

Oliver Heavy-Duty Metal-Cutting Saw

A heavy-duty production saw for precision cutting of aluminum, bronze, copper, brass, and other non-ferrous metals has been introduced by the Oliver Machinery Co., Grand Rapids, Mich. This machine, called the Oliver No. 838 plate saw, was specially designed to meet demands for accurate work and fast cutting.

The plate saw has a heavy cast-iron bed. Both the feed-motor and saw-motor units travel on a 6-foot carriage. The material to be cut is placed on the heavy cast-iron tables with the saw unit moving along the bed to cut through the material. The machine is built in any length from 4 to 40 feet, in 4-foot increments. The saw arbor is 1 1/2 inches in diameter where the saw is applied, and has collars 9 inches in diameter to support the blade. The arbor runs in large ball bearings. It is driven by multiple V-belts at 2200 rpm, and by a 20-, 30-, or 40-hp totally enclosed, fan-cooled motor operating at 1800 rpm. The feed motor is a 3-hp Reliance V-S unit with adjustable speed drive, and is totally enclosed and fan-cooled, giving speeds from 1 to 40 feet per minute. The carriage return speed is 40 feet per minute.



Oliver plate saw designed for heavy-duty metal cutting

Circle Item 121 on postcard, page 193

Sheldon Precision Lathe

A 15-inch lathe, designed to fill the gap between conventional belt-driven and geared-head types, has been announced by the Sheldon Machine Co., Inc., Chicago, Ill. This design (patent pending) has been developed to provide industry with a new type of cost-cutting machine. Although it is built to combine the capacity and power of a geared-head lathe with the economy and flexibility of a belt-driven type, it is said to be available at a comparatively low cost.

An outstanding feature of this lathe is the fully enclosed headstock with its work-holding spindle. Although the high-torque drive is direct to the spindle, all radial and thrust loads from the drive are absorbed by large, tapered roller bearings that support an input pulley in the rear of the headstock wall. Power from the pulley is transmitted to the spindle through a positive clutch in direct drive or through gears in the back-gear drive. As a result, the spindle can utilize its full capacity as a work-holder without the stresses of driving pressures or loss of power through intermediate shafts.

The spindle itself is mounted in "Zero Precision" tapered roller bearings arranged in the new box type head designed for greater accuracy and maximum rigidity. The hole through the spindle is 1 1/2 inches in diameter. Because of the unique design of the headstock, back-gears can be engaged or disengaged by a single lever on the front of the headstock. A



Precision lathe announced by Sheldon Machine Co., Inc.

3-hp motor is recommended for the high-torque drive. The apron has two independent drop-lever clutches for engaging power feeds.

The quick-change gear-box provides sixty different threads and feeds, including such threads as 7 1/2, 11 1/2, 27, and 30 threads per inch. A built-in, lead-screw reverse lever permits changing the direction of the lead-screw rotation while the lathe is running.

The swing over the bedways is 15 1/4 inches and over the cross-slide, 9 1/2 inches. The carriage is 17 1/2 inches long and has a bridge width of 6 3/16 inches. From 4 to 240 threads per inch can be cut. Power longitudinal feeds range from 0.002 to 0.120 inch, and power cross-feeds from 0.001 to 0.060 inch per revolution of the spindle. Spindle speeds range from 40 to 1250 rpm. Either 5-, 6-, or 8-foot bed lengths are available. The weight with 5-foot bed is 2220 pounds.

Circle Item 122 on postcard, page 193

Morton Boring and Turning Machine

A huge boring and turning machine designed for processing the high-pressure sections of large steam turbines has been built by the Morton Mfg. Co., Muskegon Heights, Mich. This machine is 27 feet long, 22 feet wide, and 40 feet high. The bed is 11 by 27 feet, and the work-table, 11 by 13 feet. Load-carrying capacity of the work-table is 120,000 pounds; quill diameter, 24 inches; and spindle diameter, 13 inches.

Spindle speeds range from 2 to 60 rpm. Boring capacity ranges from 16 inches in diameter for a depth of 36 inches, up to 60 inches in diameter for a depth of 96 inches. Turning capacity ranges from 50 inches in diameter for a length of 48 inches, up to 84 inches in diameter for a length of 48 inches. The turning ring speed ranges from 2 to 12 rpm. Maximum clearance under the outer turning ring is 10 feet.

Nineteen motors with a total rating of 210 hp are used to power the machine. An elevator is provided to enable the operator to change tool-heads. The front platform is elevated independently of the bridge for a travel range of 10 feet. A chip-removal conveyor with a capacity of 2 tons per hour is provided. The machine is equipped to position tools vertically and radially by electronic numerical control. It also has a closed-circuit television with the camera rotating on the spindle with the tool-head. This machine has a total weight of 525,000 pounds and will require about eight railroad cars for shipment.

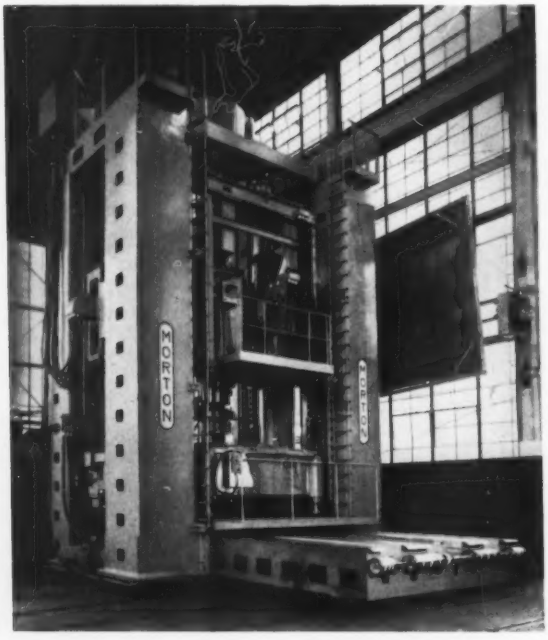
Circle Item 123 on postcard, page 193

Kaufman Tapping Machine

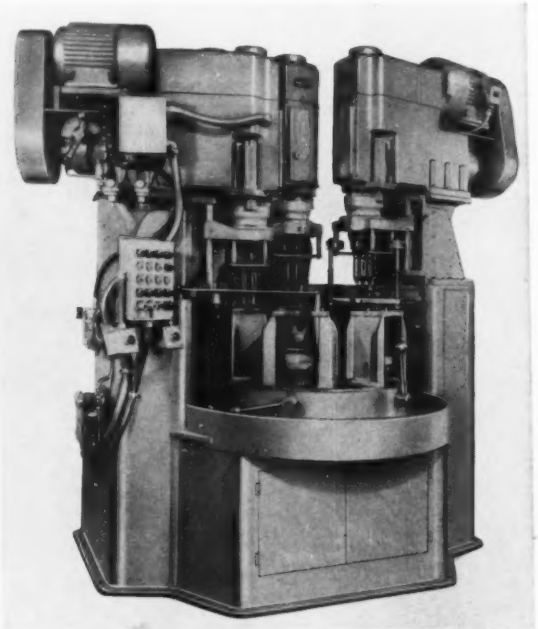
A Model 10E-1125 tapping machine equipped for drilling, countersinking, and tapping a wide variety of flanged valve bodies is now available from the Kaufman Mfg. Co., Manitowoc, Wis. This unit has three heads arranged around the five-station indexing table. The heads are standard units of the four-spindle adjustable type.

Each head is provided with a six-speed transmission, hydraulically operated adjustable feed, rapid advance, and adjustable time delay at bottom of stroke. With this equipment it is possible to handle a large range of flanged bodies, using drills, countersinks, and taps of different sizes on a variety of bolt circles.

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Giant-size turning and boring machine built by Morton Mfg. Co.



Kaufman machine for drilling, countersinking, and tapping valve bodies

Horizontal Drilling and Tapping Machine

Unimatic Machine Products, Inc., Schiller Park, Ill., has introduced a single-spindle horizontal drilling and tapping machine that is designed with a full range of automatic controls. This machine is provided with magazine feed (adaptable to hopper feed) to handle the large variety of second operation drilling, tapping, counterboring, burring, countersinking, facing, reaming, and hollow-milling operations on screw-machine parts, die-castings, stampings, or header parts. It has a capacity for drilling 0.020- to 3/8-inch holes in mild steel and for tapping holes up to 3/8 inch in diameter.

A 1/2-hp spindle motor and drive pulleys provide a normal speed range between 500 and 10,000 rpm. Adjustable spindle feed is obtained with compressed air through a 2 1/2-inch maximum stroke length by means of intake and exhaust metering screws for both top and bottom of the tandem piston-rod assemblies. This is supplemented by hydraulic control adjustment for breakthrough or controlled feed operations.

A bottom dwell adjustment furnishes additional control for fine surface finishing and holds repeatable depth limits within 0.0005 inch. The universal positioning and clamping fixture permits depth location from either the back of the part or the front face of shoulders or flanges.

An extremely simple electrical circuit combining solenoid-actuated valve and limit-switch applications synchronizes spindle operation with any feasible clamping, positioning, indexing, or escapement mechanisms.

Infinitely variable cycle control ranges up to 500 strokes per minute. The operating speed is determined by the nature of the work being performed. Normal shop-line air pressure of 80 to 100 psi is reduced through built-in regulators to suit requirements.

The spindle unit is dovetail-mounted on a heavy, accurately ground base. A rack-and-pinion mechanism with locking device permits a horizontal movement of 5 1/2 inches toward the tailstock of the machine. Clearance between spindle center and mounting base is 7 1/4 inches.

Circle Item 125 on postcard, page 193

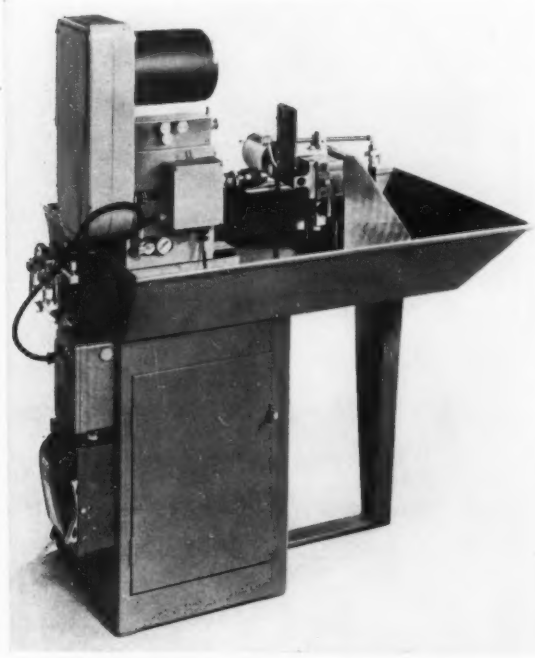
Contour-Milling Machine

A contour-milling machine called the "Hydroversion" has been introduced by the Arrow Engineering Co., Inc., Largo, Fla. This machine is equipped with a True-Trace 3-D valve for either 360-degree or 3-dimensional milling. The table is 28 by 64 inches and has a travel of 36 inches. Cross travel of the cutting heads is 42 inches and the vertical travel 10 inches. Feed rates range from 0 to 60 inches per minute in all directions.

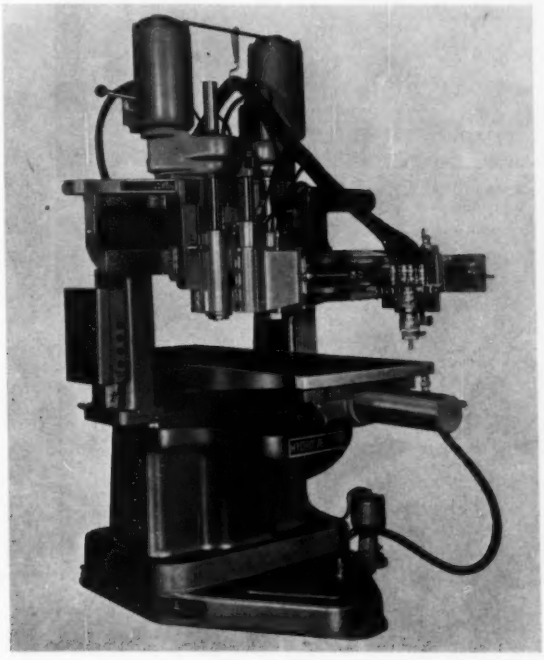
The machine is equipped with two 5-hp electric spindles mounted on 12-inch centers. Twenty-four spindle speeds are available, ranging from 87 to 2600 rpm. Spindles have a No. 40 taper, heavy-duty bearings, and permanent lubrication. The hydraulic power unit is integral with the machine and includes a 50-gallon reservoir, 5-hp electric motor and pump. The base contains a coolant reservoir with coolant pump mounted on the base. The machine has one-shot lubrication to all ways and is fitted with neoprene protective way covers.

Circle Item 126 on postcard, page 193

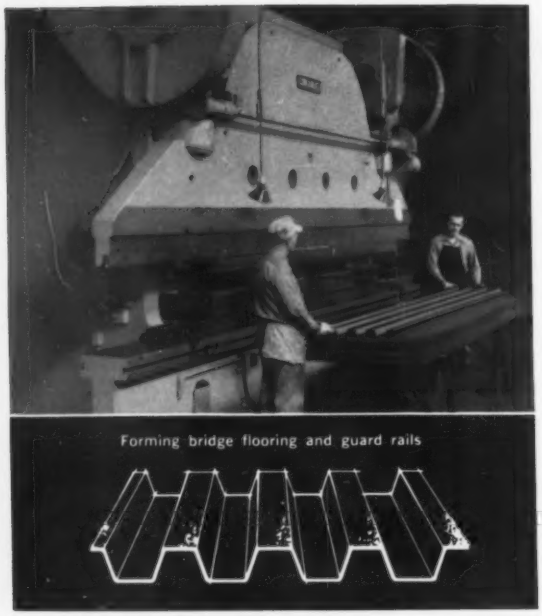
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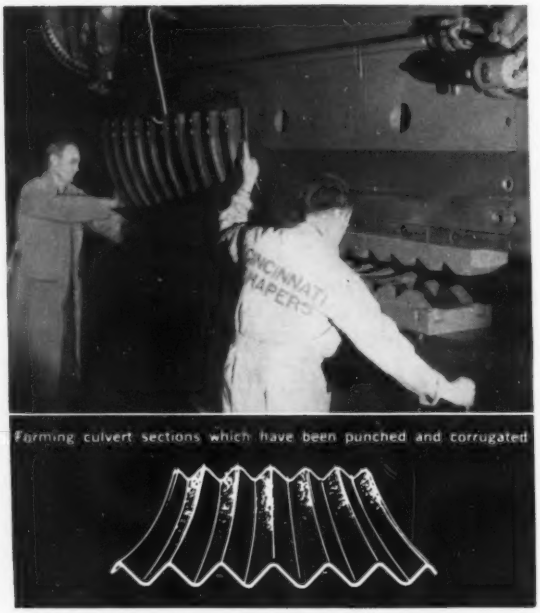
Unimatic horizontal drilling and tapping machine



Contour-milling machine built by Arrow Engineering Co.

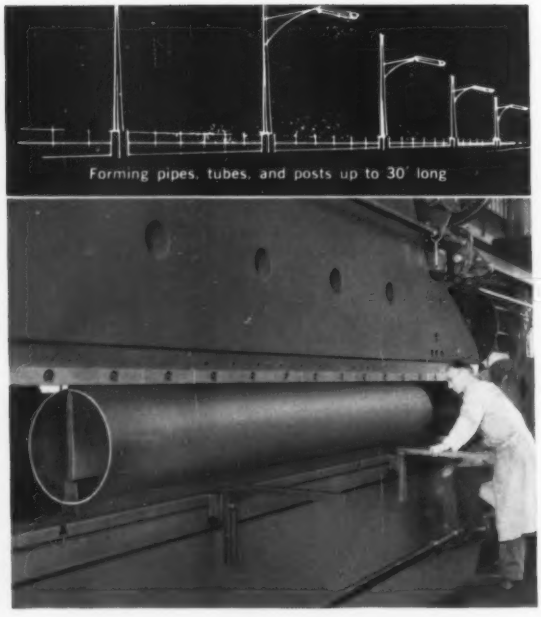


Forming bridge flooring and guard rails

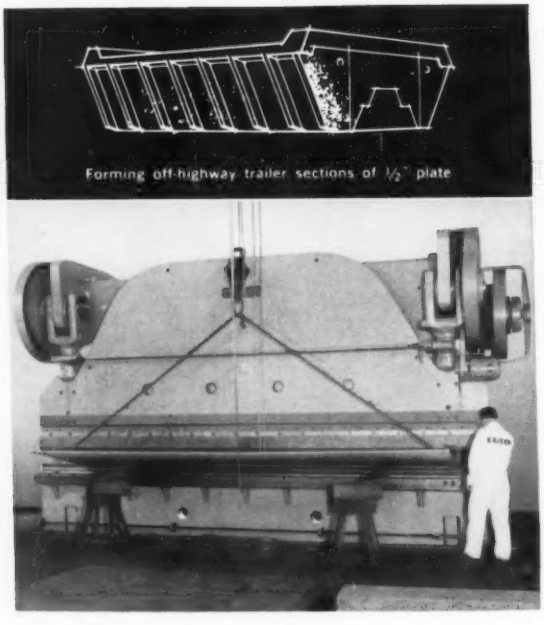


Forming culvert sections which have been punched and corrugated

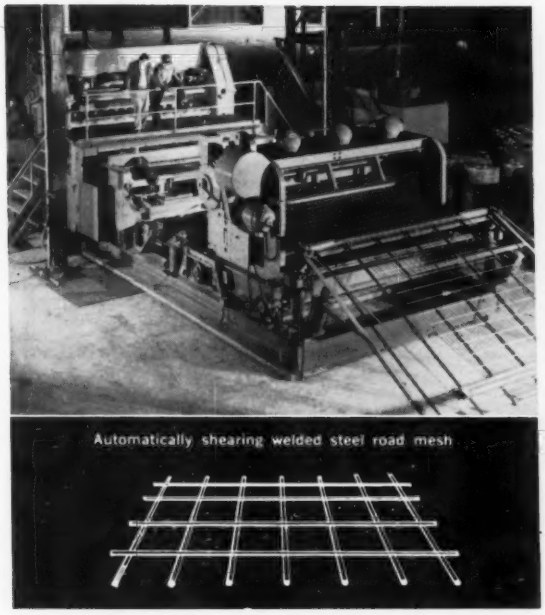
Tool up with Cincinnati® for

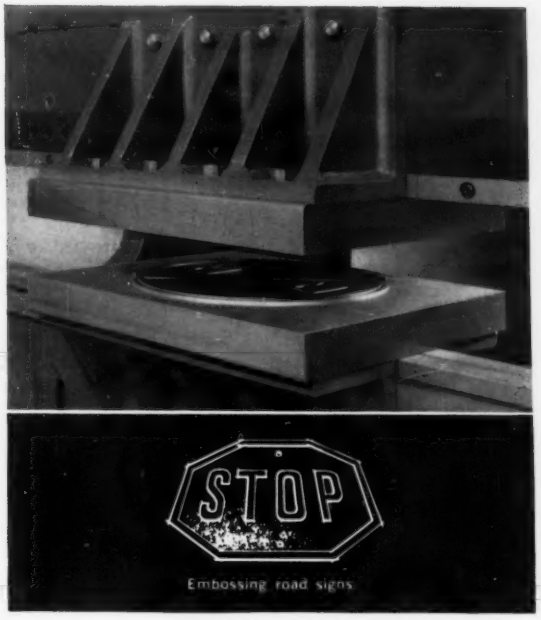


Forming pipes, tubes, and posts up to 30' long

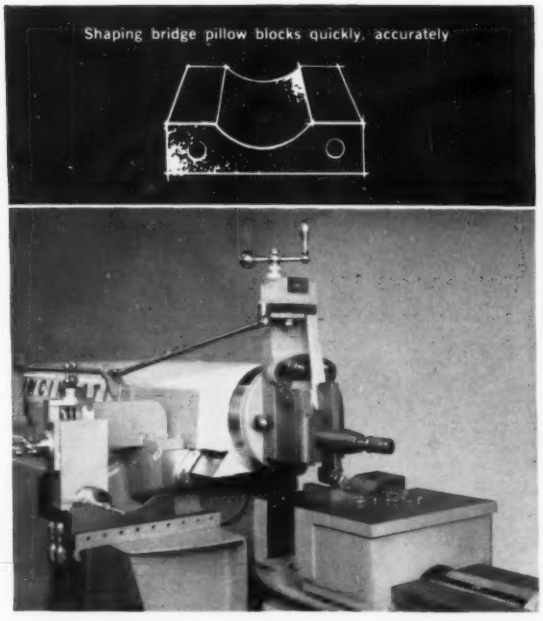


Forming off-highway trailer sections of ½" plate





America's huge road program



Here are just a few of the many jobs now being done profitably on Cincinnati® Shears, Press Brakes, and Shapers—helping to build America's highways.

Your share of the profits from this vast highway program will depend on your ability to supply metal components on time, in sufficient volume, to specifications, and at competitive prices. Whether you make guard rails or bridges, lampposts or culverts, curb forms or earthmovers—now is the time to measure your shear, press brake, and shaper capacity against the demand coming down the road.

Don't wait for competitive traffic. Write Department D for more data on these Cincinnati applications: Catalog B-5 on Press Brakes; Catalog S-7R on Shears; Catalog N-7 on Shapers.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

Starrett Tool Chests

A line of tool chests in both wood and steel styles has been announced by the L. S. Starrett Co., Athol, Mass. These chests are designed to protect and preserve the fine tools used by machinists and tool and die makers as well as by apprentices, students, and home workshop enthusiasts. Both the wood and the metal chests are available without tools, or with three different assortments of Starrett tools selected to provide basic as well as more advanced precision measuring equipment.

The metal chest, No. 200M, is constructed of rigidly reinforced steel with durable maroon, wrinkled finish and contrasting black drawer pulls. It measures 20 by 8 1/2 by 13 3/4 inches with a 19 1/2- by 7 3/4- by 3 1/4-inch top compartment and weighs 28 pounds. Seven drawers have easy-action slides with positive no-fall-out stops, plus spring clips to permit easy removal when desired. Drawers and top compartment are lined with Starrett red felt to protect the tools. The front panel interlocks with the top for complete locking, and slides under the bottom drawer when open.



Starrett mechanics' tool chests made in wood or metal, with or without tools

The wood chest, No. 200W, is made of selected grain Honduras mahogany with hand rubbed cabinet finish. It measures 20 by 9 1/2 by 13 inches with a 19- by 8 1/4- by 2 3/8-inch top compartment. It weighs 19 pounds. Nine drawers are furnished in an array of sizes to accommodate large and small tools. Drawers and top compartment are lined with Starrett red felt. The drawers have positive stops and spring clips for easy removal. The front panel slides under the bottom drawer when not in use.

Circle Item 127 on postcard, page 193

Do-ALL Magnetic Chuck and Automatic Control for Precision Surface Grinding

The DoALL Co., Des Plaines, Ill., announces a "Selectron" automatic chuck control and a "Power-Grip" magnetic chuck. These matched units are designed to provide variable holding power and a demagnetizing cycle that completely eliminates all residual magnetism. Even the thinnest and most fragile work-pieces may be easily removed from the chuck without distortion. Thus, this equipment has eliminated, the danger of damaging delicate, precision-ground work when it is removed from a magnetic chuck.



Low voltage "Power-Grip" magnetic chuck and "Selectron" control equipment applied to precision surface grinder

Consistent repetitive accuracy is obtained because the demagnetizing feature permits swift and thorough chuck cleaning and removal of even the most minute chips. Also, the 24-volt circuit keeps the chuck cool, which is essential for accuracy, particularly when dry grinding. Neither the chuck nor the work-piece heats up. The operator can quickly select the correct holding power for each job to insure safe holding without distortion of the chuck. Indicating lights show the operating condition at a glance. The Power-Grip magnetic chucks and Selectron controls are available in a wide range of sizes.

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Air Gage for Checking Missile Nose Cone

A missile nose-cone gage has been designed and built by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. This multiple-dimension "Precisionaire" gage measures the wall thickness of a nose cone at twenty-three points simultaneously. The measuring points are located at various angular positions around the periphery of the part.

With the cone positioned between the inner and outer gage members, wall thickness is measured at all twenty-three places by opposed pairs of matched Plunjet air-gage cartridges connected to the remote twenty-three-column Precisionaire instrument. A glance at the float pattern in the air-gage columns shows whether wall thickness at each point is acceptable or the amount it is out-of-tolerance. A sliding, plastic "Airechart" across the face of the Precisionaire instrument is engraved with color-coded minimum and maximum tolerance lines that also define angular position of cone.

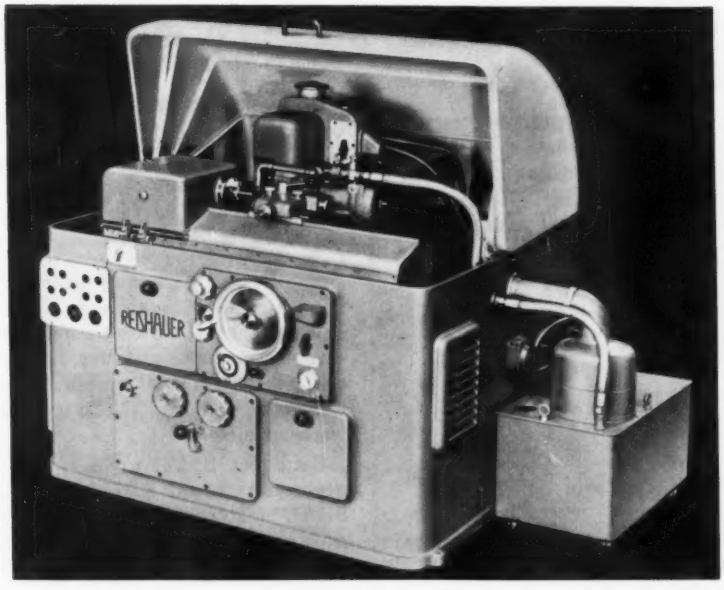


Air gage for checking missile nose cone built by Sheffield Corporation

Circle Item 129 on postcard, page 193

Automatic Thread-Grinding Machine

A Reishauer RAG, automatic thread-grinding machine is being introduced in this country by the Cosa Corporation, New York City. This single-purpose machine was developed to provide high-precision thread grinding on small parts such as: taps with straight and helical flutes (with or without relief); micrometer spindles; thread gages; and small worms with fine pitches. Single-rib grinding wheels with longitudinal feed are used exclusively. Operation of the machine is almost completely automatic, so that, after setup, it is only necessary to change the work-piece.



Reishauer RAG automatic thread-grinding machine for small parts introduced by the Cosa Corporation

Re-profiling of the grinding wheel occurs during the return stroke of the table slide, with a choice of three different re-profiling speeds. Automatic-feed compensation for decreased wheel diameter permits accurate grinding to finished dimensions. Frequency of re-profiling can be set to occur after 1, 2, 3, 4, or 6 strokes.

The machine is equipped with an automatic, electric truing device with two easily adjusted dressing heads that operate independently but simultaneously. Also available is an electric truing device with one dressing head in which one diamond tool oscillates along both flanks and describes a radius, if desired. In addition, the grinder can be equipped with a coolant temperature control system.

Lead-screw and lead-screw nut

(Continued on page 198)

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY



Technical-ities

By John S. Davey

Select proper bolt diameter

An erroneous rule of thumb worth forgetting is that no bolt under ⅝" should be used where fastened members are under stress. Yet bolts ½-inch and smaller take plenty of external loading.

HOW TO LOOK AT IT

Primarily, you have to satisfy the stress requirements . . . the load. So select bolts on that same basis: the actual strength to sustain that load.

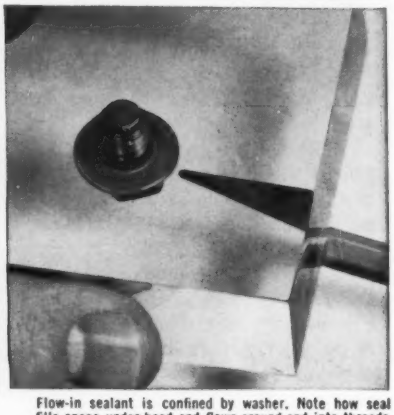
Calculating the strength requirements will tell you what bolt tensile, size, and number you need. If smaller bolts suffice, use them to avoid the penalty of overdesign. Holes can be smaller which means faster drilling and tapping. You have a chance to save materials since with smaller bolt holes, fastened members can often be made smaller too. You may also be able to standardize on a single size, saving assembly-line time.

SIZE VS. SAFETY

Remember that for a given grade of material, size tells you *capacity* of a bolt, not its *safety*. If you *tighten* a bolt to capacity, then you get safety. That's why a smaller bolt properly tightened is better and safer than a larger bolt sloppily tightened, especially where the loads are dynamic. Obviously, you reduce risk of under-torqued bolts as you reduce their size.



The new RB&W "SPIN SEAL" fasteners have spring-type washer with adhering flow-in seal . . . preassembled to standard machine or tapping screw.



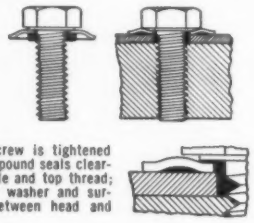
Flow-in sealant is confined by washer. Note how seal fills space under head and flows around and into threads in tightened SPIN-SEAL screw.

New SPIN-SEAL* screws give leakproof fastening

Here is a new type of composite fastener that seals by means of a unique flow-in sealant and washer.†

ASSURES TRIPLE SEAL

Concave in shape, the heat treated springy washer confines and controls the flow of sealing compound. Tightening the screw forces sealant into various spaces around (1) threads, (2) head and (3) clearance hole to give hermetic sealing.



When screw is tightened the compound seals clearance hole and top thread; between washer and surface; between head and washer.

The washer has ability to conform to curved surfaces and still seal securely against hydrostatic pressures and wind driven water. Its spring tension and flat rim give the added advantage of dynamic metal to metal seal.

ONLY THE SCREW TURNS

Washer does not turn with the screw. This prevents twisting or tearing the sealing "gasket", marring of polished surfaces, or gouging of painted finishes.

The flow-in gasketing compound is plastic rather than elastic. Stable and non aging, it won't split or ozone-check under pressure. It gives controlled flow into clearance spaces. Compounds are available to seal out water or oil.

Send for Bulletin SS-1 which gives details on RB&W "SPIN-SEAL" fasteners. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

* T.M.
† U.S & Can. Pats. Pend

Plants at: Port Chester, N. Y.; Coraopolis, Pa. Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

OPTICAL GAGING—Optical Gaging Products, Inc., Rochester, N. Y. 114-page combined catalogue and informative handbook known as General Catalogue No. 10, over half its content comprising information on optical gaging, chart gages, and fixturing. The book is indexed, covering sections devoted to chart layout methods, standard chart gages and fixtures, and contour transcribers. Copies of the new OGP Catalogue No. 10 are available, free, if requested from Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y., on company letterhead over the signature of a department head or executive.

CONTOURING SYSTEM—Monarch Machine Tool Co., Sidney, Ohio. 36-page booklet No. 2609, giving data on the function and performance of the exclusive air-gage tracer contour system for metalworking operations, including precision turning, facing and boring. Copies of this booklet may be obtained by writing on your company letterhead to the Monarch Machine Tool Co., Sidney, Ohio.

MOLDS—Meehanite Metal Corporation, New Rochelle, N. Y. Bulletin No. 23, presenting Meehanite permanent molds used in the production of metals, glass, plastics, and rubber. Copies are available without charge if requested on company stationery.

ECCENTRIC-GEARED PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. 44-page Bulletin 66A, presenting the modernized Niagara Series SE straight-side, single-atcion, eccentric-geared presses for large, heavy-tonnage drawing, punching, and blanking work. It gives thorough information on operating and design features, including: four-piece, tie-rod frame; box type welded steel slide; crankless eccentric drive; pneumatic friction clutch and brake; automatic circulating oil system; and totally enclosed air and electrical controls. 1

ALLOY STEELS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Booklet, "The Eight Steps To Risk-Proof Alloy Steels," explaining how a special, eight-point plan goes beyond normal precautions to give added protection to buyers of alloy steel. Key to customer benefits is the Ryerson "Certificate of Analysis and Hardenability" which accompanies every shipment, and which is reproduced along with an explanation of the end-quench hardenability test that is given all as-rolled and annealed alloy steel selected for Ryerson stocks. 2

DIE-CASTING MACHINES—The Cleveland Automatic Machine Co., Cincinnati, Ohio. General Bulletin, presenting a recently expanded line of Universal high-pressure hydraulic die-casting machines. It gives detailed descriptions and specifications of Cleveland Models 50, 200, 400-N, 500-N, 650, 800, and 1000, representing machines ranging in locking pressures from 50 to 1000 tons. . . 3

LUBRICATION SYSTEMS—Lincoln Engineering Co., St. Louis, Mo. Bulletin presenting applications and advantages of the new "Ram-Pumps," complete with photos and drawings of different types of installations. Also shown are descriptions, specifications and dimensions of lubricant injectors that are used with the new pumps, plus various controls and accessories for Lincoln Automated Centralized Systems. 4

HYDRAULIC PRESSES—American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. Bulletin No. 1036-C, giving complete description and specifications on Elmes Hydrolairs (R)—small type, air-powered hydraulic presses for plastics and rubber molders. Available in

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30-, 50-, 75-, and 100-ton capacities with hand-lever control, with or without hot plates. 5

GUN DRILLS—Star Cutter Co., Farmington, Mich. Catalogue No. SC-110, describing Starbore carbide gun drills for high-speed production of precision holes from the solid. Complete application information including drill construction, sharpening, tool life, specifications, machine tool requirements and coolant requirements is included in the catalogue. 6

ULTRASONIC CLEANERS—Narda Ultrasonics Corporation, Westbury, N. Y. Catalogue describing "SonBlaster" ultrasonic cleaners. It provides detailed descriptions of the complete Narda SonBlaster stock line, ranging from 35-watt systems up to 2.5-kilowatt systems, and with related SonBlaster transducers ranging in capacity from 3/8 gallon to 75 gallons. 7

VACUUM-MELTED ALLOYS — General Electric Co., Metallurgical Products Department, Detroit, Mich. Data and specification sheets covering vacuum-melting techniques and high-temperature vacuum-melted alloys. One of the new alloys announced is Rene 41, designed for use in severely stressed high-temperature applications, such as jet-engine components or high-speed airframes. 8

BORING MACHINE—Ex-Cell-O Corporation, Detroit, Mich. Bulletin featuring way type precision boring machines. Ex-Cell-O machines accept larger workpieces than the standard Ex-Cell-O precision boring machines and are designed on a "building-block" principle to facilitate changes in production requirements. 9

HIGH-FREQUENCY EQUIPMENT—The Louis Allis Co., Milwaukee, Wis. Bulletin No. 2250, on "High Frequency Equipment," pointing out the value of this equipment as a means of increasing the output or efficiency of present-day high-production machinery often limited by standard, 60-cycle power. 10

NUMERICAL CONTROLS—Marac Machinery Corporation, Yonkers, N. Y. Catalogue presenting the "first machine tool in the world on which numerical control is offered as standard (not optional) equipment," the Schwartzkopff KBF 2 boring and milling machine, imported from Germany. Thirty illustrations describe its design and operation. 11

HIGH-TEMPERATURE MATERIAL—Haynes Stellite Co., New York City. Booklet featuring a new material, silicon nitride—designed to operate up to and over 3000 degrees F. in certain atmospheres. Tubes made of the new material have been continuously immersed in unalloyed aluminum for 3000 hours and showed no evidence of attack. 12

BUTT-WELDED TUBING — Pittsburgh Tube Co., Pittsburgh, Pa. 60-page booklet, "Handbook of Cold Drawn, Buttweld Mechanical Steel Tubing" describing the manufacture, uses, and economies of the butt-welded product in industry. Pertinent metallurgical, mechanical, and engineering data are included. 13

VOLTAGE REGULATORS—Power Transformer Department, General Electric Co., Pittsfield, Mass. Bulletin describing the functions and operational concept of "Inductrol" voltage regulators, which hold interest for the military electronics design engineer industrial original equipment manufacturer and others in industry. 14

SWITCHES—Electrical Mfg. Division, The National Acme Co., Cleveland, Ohio. Bulletin No. EM-5824, describing the snap-lock Series D-2400 heavy-duty, limit switches. It lists other design and construction features such as water- and oil-tight covers, and separate enclosures within a single housing for the mechanical and electrical sides. 15

PRESSES—Sales Service Machine Tool Co., St. Paul, Minn. Bulletin presenting new 40-ton, open-back, inclinable press featuring steel-frame weldment that provides generous ram and bed areas and depth of throat to accommodate large die sets. Standard and optional features are described and complete specifications included. 16

MILLING CUTTERS—McCrosky Tool Corporation, Meadville, Pa. Bulletin No. 582, describing the construction of cutters using square and triangular carbide inserts. It lists sizes and dimensions of standard shell end, face and half sidemills and illustrates a variety of "Specials" designed to meet unusual requirements. 17

LIFT TRUCK—Lewis-Shepard Products, Inc., Watertown, Mass. Circular No. 35, presenting the first narrow-aisle, rider type, electric tiering truck with a 24-volt electrical system. The presentation contains complete operating and maintenance details on the recently introduced Lewis-Shepard 24-volt Model "MN" truck. 18

AUTOMATIC SCREW MACHINES—Beaver Industries, Chicago, Ill. Booklet telling how companies with automatic screw machine departments can increase production, quality, and profits by keeping their equipment in top operating condition at a fraction of new machine cost. Pictures show the complete rebuilding of a Brown & Sharpe automatic screw machine. 19

DRIVES—Reliance Electric & Engineering Co., Cleveland, Ohio. Booklet D-2506, featuring Reliance "V*S" drives, which provide precise, adjustable machine speeds from in-plant A C circuits. It covers the manufacture and functions of the drive components, including regulators, exciters, motor-generator sets, operator's panels, and Super 'T' motors. 20

SPECIAL TOOLS—McCrosky Tool Corporation, Meadville, Pa. Catalogue No.

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S-19, illustrating and describing wide variety of tools specially designed to combine two, three, four or more related machining operations with just one tool, and one setup, thus cutting costs and assuring absolute concentricity and uniformity of finished work. 21

TOOL SHARPENING—Heald Machine Co., Worcester, Mass. 32-page booklet No. 13-25-14, entitled "How to Ruin a $50,000 Machine," for production superintendents and machine operators. It points out three ways of destroying the effectiveness of boring or other machines using single-point tungsten-carbide cutting tools by improper sharpening. . . . 22

DUCTILE IRON—Hamilton Foundry & Machine Co., Hamilton, Ohio. Folder presenting engineering and design advantages of ductile iron. It indicates the major determining factors in achieving each of these engineering properties in foundry production. 23

TRACER LATHE—Sundstrand Machine Tool Co., Rockford, Ill. Circular entitled "Sundstrand Model 14T Multi-Cycle Hydraulic Tracer Lathe," featuring a lathe for short or long runs. It has the advantages of fast setup, easy tool maintenance, etc. Specifications are given. . 24

DRILLS—Steptool Corporation, Los Angeles, Calif. Bulletin featuring Helixpoint drills as produced on the Steptool relief-grinding fixture. It covers two case histories of performance and describes the grinding fixture used for grinding Helixpoints on drills from No. 80 through 1 inch diameter. 25

IMPACT EXTRUSIONS—Mueller Brass Co., Port Huron, Mich. Data book featuring new metalworking process, "cold-prest" impact extrusions. This process offers advantages in the production of tubular and hollow-shaped parts and products in almost every industry. . . . 26

BORING AND TURNING MACHINES—King Machine Tool Division, American Steel Foundries, Cincinnati, Ohio. Catalogue No. K-7, giving detailed description and specifications on King electrically controlled, vertical boring and turning machines. 27

MOTORS—Bodine Electric Co., Chicago, Ill. Bulletin describing the construction of its A C and D C Type "N" fractional horsepower motors. Type N motors are available in three basic sizes, and each size is furnished in several lengths. . . 28

TWIST DRILLS—Cincinnati Lathe & Tool Co., Cincinnati, Ohio. 28-page booklet, "You're On The Road To Better Drilling," showing how improved precision and economy may be obtained in drilling operations. The new Cincinnati spiral-point drill geometry is explained. 29

THREAD ROLLING MACHINE—Landis Machine Co., Waynesboro, Pa. Bulletin No. E-60, illustrating and describing the two-roll cylindrical die machine "Lanhyrol" which features four distinct methods of rolling work-pieces 3/16 inch to 3 inches in diameter. 30

MOTORIZED SPINDLES—The Cincinnati Electrical Tool Co., Cincinnati, Ohio. Catalogue No. S-58, containing descriptive information on and illustrations of motorized spindles from 1/2 to 10 hp. Also included are belt-driven spindles, feeds, slides, and a complete line of accessories. 31

WELDING SYSTEM—J. B. Nottingham & Co., Inc., New York City. 22-page bulletin No. E15-58, outlining details of a "Multi-Arc Constant Potential" welding system. The bulletin gives specifications, principles of operation and characteristics, power requirements, etc. 32

SMALL MOTORS—Barber-Colman Co., Rockford, Ill. Calalogue No. U-1, featuring extensive information on unidirectional non-geared motors. General information including charts, diagrams, and data on duty cycle, power sources, variations, braking, controls, and explanations is also given. 33

ENVIRONMENTAL CHAMBERS—Webber Mfg. Co., Inc., Indianapolis, Ind. 28-page brochure featuring a variety of refrigeration units, custom rivet coolers, quench tanks, explosion-proof chambers, etc. It contains charts and gives twenty-nine applications. 34

MILLING MACHINE—Sundstand Machine Tool Co., Rockford, Ill. Circular entitled "Sundstand C1 Mechanical Feed Rigidmil," presenting special features of a milling machine: automatic lubrication, unusually heavy spindle, automatic table cycles, etc. 35

STORAGE RACKS—Palmer-Shile Co., Detroit, Mich. Brochure covering varieties of adjustable storage racks in a wide range of applications. These include the storage of aluminum, brass, steel and copper, diesel oil and engine parts, etc. 36

MARKING TOOLS MACHINERY—Geo. T. Schmidt, Inc., Chicago, Ill. 192-page

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calalogue No. 16, describing a complete line of marking tools and marking machinery and equipment. Included are sections on engraved stamping dies, type and type holders, and other tools for every marking application. 37

ANALOG COMPUTER—Mid-Century Instrumatic Corporation, New York City. Brochure and folder describing the new Mid-Century MC-5800 master precision analog computer. Fourteen pages of specifications and description are included in a 4-page folder. 38

GEARSHIFT DRIVE—Lima Electric Motor Co., Inc., Lima, Ohio. Bulletin describing the construction and typical applications of Lima gearshift drives, showing original equipment photos. 39

SPEED REDUCERS—Alten Foundry & Machine Works, Inc., Lancaster, Ohio. Circular outlining features of this company's reducers with helical or herringbone gears. 40

HEAT-TREATMENT—Lindberg Engineering Co., Chicago, Ill. Bulletin No. 242, containing photographs and describing hardening, carbonitriding, and carburizing furnaces of batch and continuous types. 41

METAL-CUTTING TOOLS—O K Tool Co., Milford, New Hampshire. Brochure presenting end-mills and milling cutters of various types, and with many applications. 42

DIAL INDICATORS—Petz-Emery Inc., Pleasant Valley, N. Y. 12-page catalogue "D," on their expanded line of "Em-re" dial indicators. 43

ROTARY TABLES—Pratt & Whitney Co., Inc., West Hartford, Conn. Brochure presenting rotary tables for circular spacing and angular positioning. 44

SMALL DIE-CASTINGS — Gries Reproducer Corporation, New Rochelle, N. Y. Bulletin covering a wide variety of zinc-alloy, die-cast, and molded thermoplastic products. 45

MAGNETIC AMPLIFIER DRIVE—Cutler-Hammer, Inc., Milwaukee, Wis. Booklet EN-65, featuring "Ultraflex M" adjustable-speed drives in sizes from 1 to 200 hp, utilizing magnetic amplifiers for power conversion. 46

BORING-BARS—Portage Double-Quick, Inc., Akron, Ohio Brochure outlining boring-bar cartridges, boring heads, and boring-bars, with specifications and applications. 47

MINIATURE UNIVERSAL JOINTS—Falcon Machine & Tool Co., Cambridge, Mass. Circular presenting "Mini-Joint" for use in instrumentation equipment or in other systems operating at low mechanical power levels. 48

MULTIPLE-SPINDLE BAR AUTOMATIC—National Acme Co., Cleveland, Ohio. Bulletin MRA-58, describing a new 7/16-inch automatic for small-part production. Illustrations and diagrams are included. 49

TOOL AND DIE MILLING MACHINE—Cincinnati Milling Machine Co., Cincinnati, Ohio. Circular describing three-dimensional, hand-guided, hydraulic tracer control. 50

PORTABLE ELEVATOR—West Bend Equipment Corporation, West Bend, Wis. Circular presenting "Weld-Bilt Hy-Boy Verti-Lift" with many applications in loading and stacking. 51

FORM TOOLS—Lund Mfg. Co., Biddeford, Me. Leaflet presenting special feature of "Jet-Cut" radius form tools. . . 52

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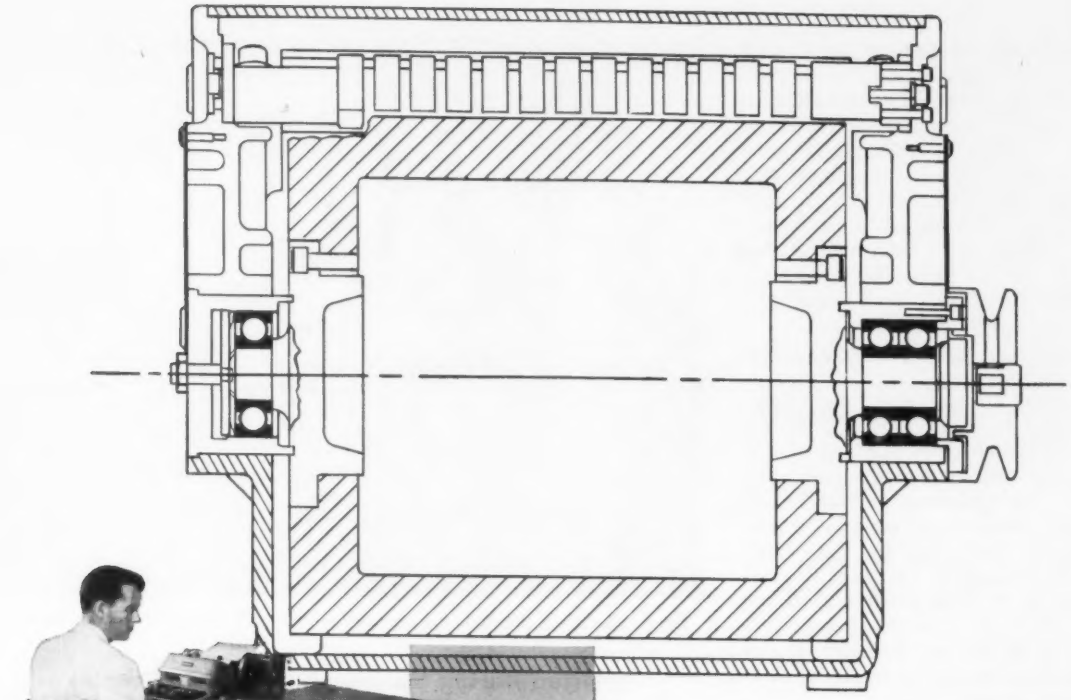
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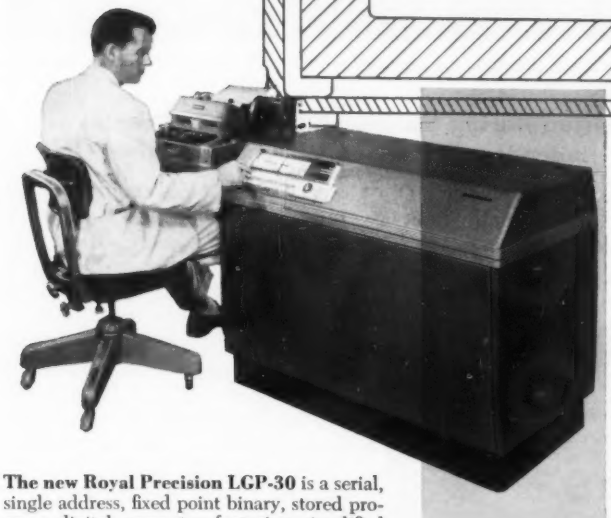
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in design of desk-size LGP- 30 digital computer!

Precise performance assured in Librascope's Fafnir-equipped LGP-30

Small as a desk, but it "thinks big"! No less than 4096 words can be recorded on the magnetic memory drum of the new Royal Precision Electronic Computer LGP-30. Moreover, this compact unit, made by Librascope, Inc., a subsidiary of General Precision Equipment Corporation, can be rolled where it's needed and plugged into any conventional wall outlet.

At the heart of this versatile computer, Fafnir super-precision type ball bearings maintain the precise alignment and high sensitivity required of the drum component. Counterbored to take a wide range of thrust, and radial loadings, these bearings provide the rigidity, extremely close-running accuracy, and low torque essential in this exacting application.

Fafnir's contribution to the development of the LGP-30 is another case history example of the high caliber and comprehensive scope of Fafnir design engineering services available to *you*. Take advantage of it when you have a bearing problem. The Fafnir Bearing Company, New Britain, Conn.

The new Royal Precision LGP-30 is a serial, single address, fixed point binary, stored program digital computer featuring simplified design and ease of operation. The unit is designed to make computer use economical and simple enough for more widespread application.

Fafnir Super-Precision Type Ball Bearings are used in duplex pairs, mounted back-to-back, at the pulley end of the LGP-30 memory drum, and singly at the opposite end. These preloaded, angular-contact bearings, equipped with composition or bronze retainers, are widely used in precision-built mechanisms.



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For more data on any products advertised this issue use card, page 193

are hardened, ground, and lapped. Change-gears are precision ground to assure high grinding accuracy. Maximum grinding length is 9 3/4 inches; distance between centers, 20 inches; maximum work-piece diameter, 3/4 inch; minimum work-piece diameter, 0.04 inch; and pitch range, 6 to 80 threads per inch. The machine is 6 by 6 feet by 6 feet 7 inches and weighs 5300 pounds.

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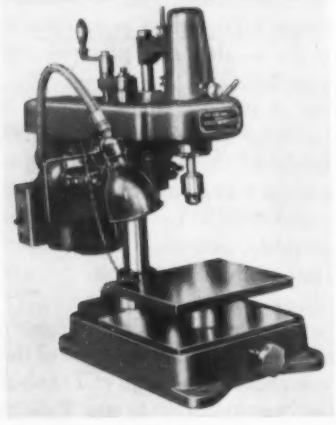
Sensitive Drilling Machine

A model AF-7B high-speed sensitive drilling machine, designed for the precision production of small holes in any material, is now being marketed by the High Speed Hammer Co., Inc., Rochester, N. Y. This machine will use drills in sizes ranging from No. 0 to 5/16 inch in diameter. It can drill to the center of an 11 3/4-inch circle.

The head has a vertical travel of 8 inches and can be moved through a complete circle. Spindle travel is 2 3/8 inches. Maximum distance from chuck to base is 10 7/8 inches and from chuck to round table, 8 3/4 inches. Standard equipment includes a 5 1/2-inch diameter table. A 7- by 9-inch table is available.

Speeds of 750, 1500, 3000, and 6000 rpm are available. The molded endless belt is made to eliminate stretching. The machine is 11 inches wide by 24 1/2 inches deep, and 25 inches high.

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High-speed sensitive drilling machine sold by High Speed Hammer Co.

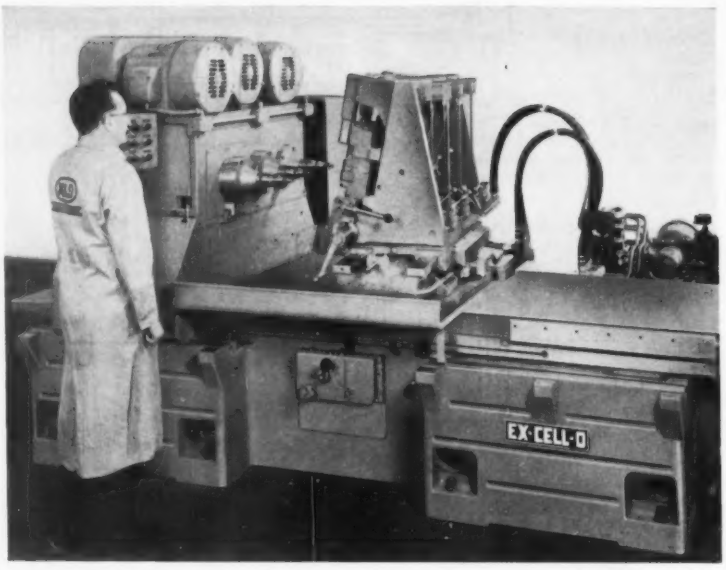


Fig. 1. Ex-Cell-O precision boring machine set up to process cylinder heads

Precision Boring Machine Equipped to Process Cylinder Heads for Heavy Tractor Engines

The Ex-Cell-O Corporation, Detroit, Mich., has recently built a three-spindle, single-end, precision boring machine, Fig. 1, and equipped it to perform boring, plunge-facing and chamfering operations. The unit operates on two different types of cylinder heads for heavy tractor engines. A total of twenty-one surfaces is machined from rough castings like the one shown in Fig. 2, in one pass, taking a cut between 1/8 and 3/16 inch deep.

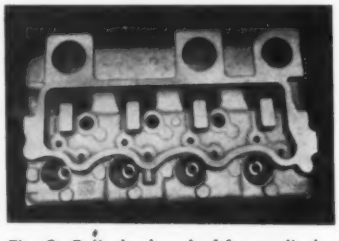


Fig. 2. Cylinder head of four-cylinder engine processed on machine in Fig. 1

After being loaded on the machine, the component is hydraulically clamped and the machining cycle started. The table rapid-traverses to the left, the spindles start their rotation, and the feed traverse commences. At the end of the feeding stroke, the spindles stop and the table rapid-traverses out of the cut to clear the tooling. Because of the close center distances between the surfaces machined on the component, the fixture is designed to index and repeat the operation on the second set of holes. Following the end of this feed stroke, the fixture and table return to the starting position. Both four- and six-cylinder components are machined in this manner. Production in either case is seventeen to eighteen parts per hour.

Circle Item 132 on postcard, page 193

High-Precision Instrument Ball Bearings

Unique integral shields are featured in a line of high-precision ball bearings for instruments, now being manufactured by the Split Ballbearing Division of MPB, Inc., Lebanon, N. H. Known as Type TWF, the bearings are of thin-section design, made in twelve sizes, with bores ranging from 5/8 inch through 3 1/16 inches in diameter. The integral-shield feature is said to be possible only with the patented "Split Ballbearing" design. Integral shields are formed by extending the lands of the inner and outer rings to



"Split Ballbearings" with integral shields



Anocut-Hammond electrolytic tool grinder

within a few thousandths of an inch of each other. The resulting close-clearance annulus, when filled with lubricant, functions as an effective seal without the friction of contact seals.

The ball races in Type TWF bearings are of deep-groove type with continuous shoulders. Because full ball complements are used, Type TWF bearings offer the maximum radial and two-directional thrust capacity possible in a radial ball bearing of its dimensions. A companion Split Ballbearing series, known as Type TWA, is also available. The latter bearings are similar to Type TWF, except that alternate balls are undersized and act as separators for the load-carrying balls so that torque in the bearing is reduced.

Circle Item 133 on postcard, page 193

Electrolytic Tool Grinder

The Anocut Engineering Co., Chicago, Ill., in cooperation with Hammond Machinery Builders, has made available a combination electrolytic chip-breaker and cup-wheel grinder. This machine is especially adapted for use in metalworking shops with medium-volume and medium-duty work, and for tool-grinding operations in which a dual-purpose grinder can be used to advantage. Thus, shops with a work volume insufficient to require the use of a single-duty electrolytic grinder may obtain the advantages of electrolytic grinding for a relatively modest investment.

The electrolytic power supply unit is located in the base of this Hammond CME-6 machine. The controls are set at eye level and can be swiveled to face the side of the machine which is being operated. The output capacity of the electrolytic supply unit is 150 amperes, which is sufficient for all chip-breaker grinding and offhand grinding of small and medium-sized tools.

Circle Item 134 on postcard, page 193

Radial Saw for Wood and Metal Cutting

A 9-inch radial saw, called the "Super 900," designed for safe and fast cutting operations, has been introduced by the Rockwell Mfg. Co.'s Delta Power Tool Division, Pittsburgh, Pa. This machine has sufficient capacity for general woodworking operations in industrial plants, as well as for cutting metal sheets, tubing, and extrusions.

Major improvements in this saw over previous models include a more powerful motor and up-front controls for adjusting the table fence. The motor, a 1-hp model that actually develops up to 2 hp while under load, enables the saw to cut straighter, faster and smoother. With the up-front controls, the fence can be positioned and locked from the front of the saw more quickly than on previous models.

The saw has a cross-cut capacity of 15 inches and will rip to the center of a 48-inch panel. Maximum depth of cut is 2 1/2 inches and dado capacity is 13/16 inch wide with a 6-inch dado. The 1-hp motor has an integral overload reset button, lubricated-for-life bearings, and dual 115/230 voltage. Full-load motor speed on 60-cycle current is 3450 rpm.

Circle Item 135 on postcard, page 193



Delta "Super 900" radial saw

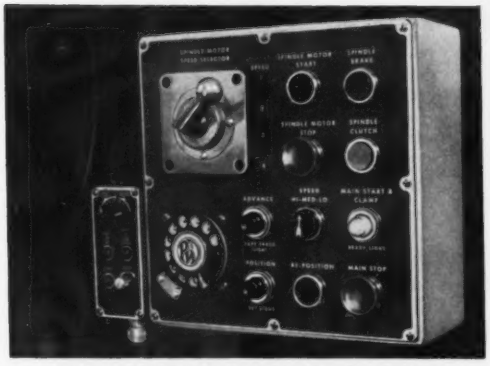

BIGGEST

Work-Size Capacity

. . . ever offered in a Precision Jig Borer!

the New PRATT & WHITNEY 4EA

with 70-inch height capacity from table to spindle end



NEW DIAL-TYPE CONTROL STATION



NEW INPUT DATA DISPLAY PANEL

This new P&W Jig Borer provides the extra capacity you need to handle large components. And – locating to *.0001"* – it has the dependable accuracy you need to meet the high standards of the aircraft, missile, nuclear energy and other industries where extreme precision is a must. Table-top-to-spindle-end maximum distance is 70", with a combined travel of head and quill of 64". As a result, the spindle can be brought within 6" of the table surface. It has the capacity to machine to the center of a workpiece 80" in diameter. Despite its greatly increased height, the 4EA Jig Borer has an accuracy of vertical alignment equal to that of all Pratt & Whitney Jig Borers. This is made possible, by an entirely new column design, with the counterbalances supported by an independent superstructure and not by the column itself.

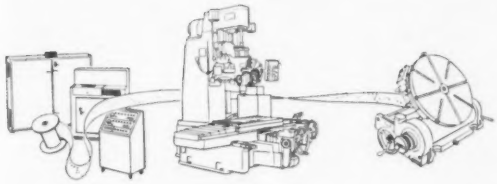
NEW DIAL-TYPE NUMERICAL CONTROL

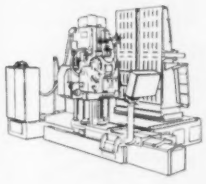
To bring the greatest possible speed and efficiency to your high-precision jobs . . . and eliminate operator errors . . . the 4EA Jig Borer is equipped with P&W Numerical Control. This system provides for automatic positioning of the rectangular work table and, if desired, for the built-in rotary table as well.

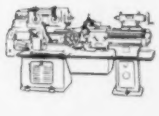
Under P&W Numerical Control, the 4EA Jig Borer can be positioned automatically by a punched tape or – where tape control is not desired – the operator can feed positioning data into the machine using either of the 2 Control Stations. These compact stations feature a new control system that allows the operator to *dial* positioning data as quickly and easily as he dials a phone number. Since one of these stations is located at the front of the bed and the other on the spindle head, one will always be handy to the operator's hand. Operating under either tape or dial control, input data is always clearly indicated on a Display Panel located on top of the Tape Reader. This provides a continuous double-check on the correctness of positioning data.

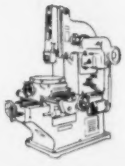
If your jobs demand big *capacity and extreme precision combined with peak production efficiency, the new Pratt & Whitney 4EA Jig Borer has* everything *you need to handle your work faster and more accurately. Write now for more complete information on the 4EA and on other P&W Precision Jig Borers.*

PRATT & WHITNEY COMPANY, INC.
12 Charter Oak Blvd., West Hartford, Conn.









NUMERICAL CONTROL . . . JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

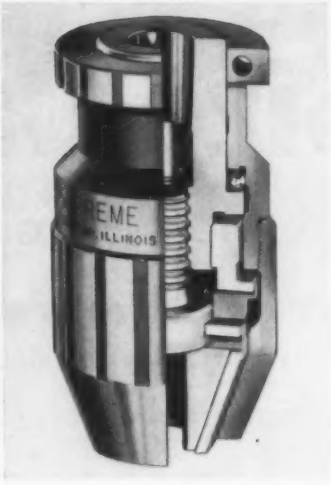
MACHINE TOOLS • GAGES • CUTTING TOOLS

Keyless Chuck

The Supreme Products Corporation, Chicago, Ill., is introducing a keyless industrial chuck called the "Precisionist." It is intended for use on the production line and in toolrooms wherever close tolerances are necessary.

The chuck jaws are made of chrome-molybdenum alloy steel. Other parts are made of comparable high-quality steels which, in most instances, are hardened. The ball-bearing construction is said to give a 100 per cent sure grip on cutting tools, yet allow the chuck to be opened easily with the fingers. They are now available in 1/2- and 5/8-inch capacity sizes.

Circle Item 136 on postcard, page 193



"Precisionist" keyless chuck

Slotting Attachment for Nichols Millers

The W. H. Nichols Co., Waltham, Mass., has announced the development of a universal slotting attachment for its milling machines which enables them to do many jobs formerly requiring the use of a costlier machine. This precision-built accessory can be operated either vertically or horizontally, or at any angle in the vertical plane. Additional flexibility is provided by the swiveling clapper-box which pivots 90 degrees to the right or left of center.

The unit is mounted in a circular T-slot on the nose of the horizontal miller spindle and is driven by the spindle. The number of strokes per minute is the same as that of the driving spindle. The slotting attachment is interchangeable with the Nichols vertical milling head and can be mounted on all Nichols millers of recent manufacture, as well as on older machines that are equipped with the vertical-head adapter.

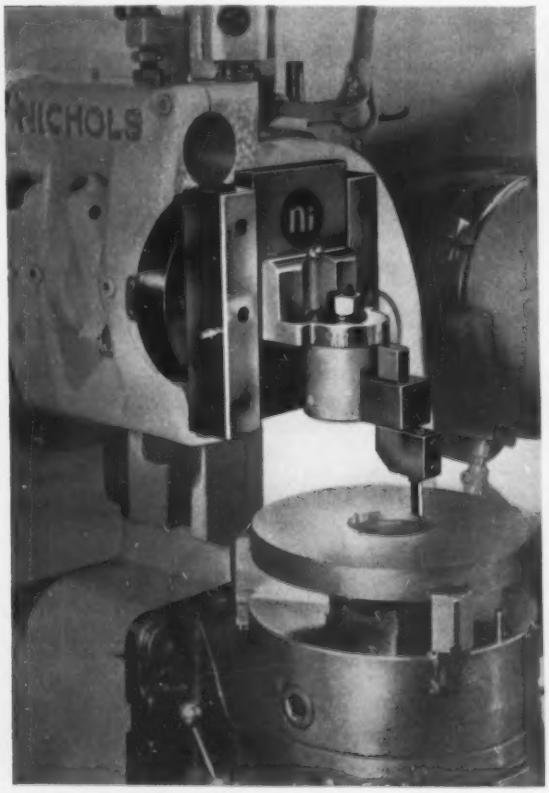
The Robert E. Morris Co., West Hartford, Conn., are national distributors of Nichols milling machines.

Circle Item 137 on postcard, page 193

Hayes High-Temperature Vacuum Furnace

A vacuum furnace capable of reaching controlled temperatures of 3000 degrees F. has been brought out by C. I. Hayes, Inc., Cranston, R. I. This equipment

(Continued on page 204)



Universal slotting attachment for Nichols milling machines



Hayes high-temperature vacuum furnace



introducing a

NEW

OLOFSSON

HEAVY DUTY PRECISION BORING MACHINE

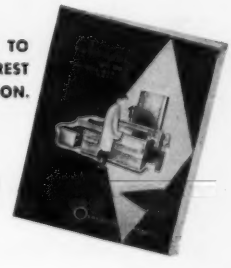
Designed for better precision finishing...semi-finishing...and roughing of large, bulky parts

This newest in the line of Olofsson Precision Boring Machines, the Model 22, is designed for more profitable heavy-duty rough and finishing boring, facing, chamfering, turning and grooving operations. Put one to work . . . and profit potential goes up. Because of the versatility of its new design, operating costs go down.

MODERN, WITH 22 QUALITY-DESIGN FEATURES, the Olofsson Model 22, weighs a hefty 7,600 lbs., untooled; and incorporates such design features as:

- *Extremely low ratio, height to width, of spindles to ways.*
- *Hardened and ground Alloy Steel flat and vee ways.*
- *Extra-large fixture mounting provides maximum stability for mounting large work pieces.*
- *Integral chip chutes completely surround any fixture tooling.*

WHATEVER YOUR PRODUCTION REQUIREMENTS. IT WILL PAY YOU TO FULLY INVESTIGATE THE MODEL 22. CONTACT YOUR NEAREST OLOFSSON REPRESENTATIVE. Or, if you prefer, write direct to OLOFSSON.



THE OLOFSSON CORPORATION

2729 LYONS AVENUE, LANSING, MICH. *Phone:* IVanhoe 4-5381

MANUFACTURERS OF PRECISION BORING AND SPECIAL MACHINERY

makes possible a wide range of heat-treating processes, including hardening, annealing, brazing, sintering, degassing, and reduction. It can be heated to full temperature within half an hour. After the work has absorbed heat to the full specified requirements, the furnace can be cooled to below 700 degrees F. within half an hour to permit unloading.

The Hayes furnace is of "cold-wall" construction, the entire chamber of heat-reflecting, nickel-clad steel being surrounded by a circulating water jacket. Thus, the need for a refractory lining is eliminated. Instead of employing an inert atmosphere to protect the work, the furnace uses a high vacuum on the order of 0.1 micron. With this equipment the work comes out of the furnace as bright as it went in, with no oxidation or discoloration. The vacuum actually functions as a reducing atmosphere for the removal of discoloration that may have resulted from preceding machining operations. The newly designed heating element of the furnace consists of shaped plates instead of coils, and is self-supporting.

Circle Item 138 on postcard, page 193

Threadwell Precision Internal Grinding Head

The Threadwell Tap & Die Co., Greenfield, Mass., has introduced a "Grind-A-Matic" air-turbine grinding head with radial feed that can be adjusted without stopping the machine. This permits precision grinding to proceed without interruption. The grinding head can be mounted on a jig-borer, boring mill, lathe, milling machine, drill press, or other comparable machine tool. The planetary action of this head is well adapted for close-tolerance toolroom work on dies and fixtures, as well as production jobs.

Fine radial adjustments can be made in increments of 0.0002 inch over a range of "0" to 0.70 inch in diameter by means of a graduated collar which is spring-loaded to eliminate backlash. Once set, the collar can be locked in position. Coarse adjustment from "0" through 1 1/4-inch grinding radius is made while the spindle is stationary. With nothing but standard equipment, holes from 1/8 inch through 2 1/2 inches in diameter can be precision ground. Holes of less than 1/8 inch in di-

(Continued on page 206)



Internal grinding head and accessories made by Threadwell Tap & Die Co.

Let me show you*



**Bob Marr,*
P&J Representative
Houston, Texas
Telephone: MOhawk 7-3964

how two P&J Automatics helped Rockwell Manufacturing Co.

JOB FACTS:

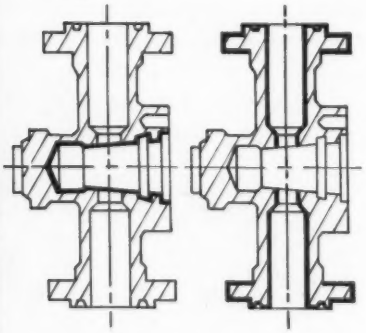
PART: *Valve Body*

MATERIAL: *Steel Forging*

REQUIRED: *A series of 22 roughing and finishing cuts involving very heavy metal removal*

THE MACHINES: *2 P&J 4-U Automatic Turret Lathes*

THE RESULTS: *A part completed in only 3 fully automatic cycles... with machining time reduced 71%.*



FIRST OPERATION

SECOND OPERATION

BLACK AREAS INDICATE METAL REMOVED

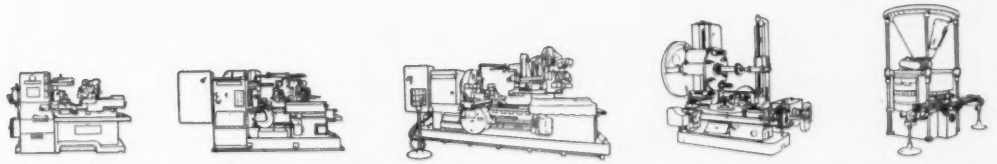


. . . . REDUCE MACHINE-HOURS 71%!

The Rockwell Manufacturing Company of Sulphur Springs, Texas, a leading producer of valves for petroleum and other industries, was using hand-type turret lathes to produce finished valve bodies from rough steel forgings. Looking for a way to reduce costs on this operation, Rockwell purchased two Potter & Johnston 4-U Automatic Turret Lathes. Machine-hours for this operation have been reduced 71% and man-hours have been reduced 86%. In addition, the hand machines and their operators have been released for other work they can handle more profitably, and overall plant production has been increased.

If the parts *you* manufacture require a series of complex cuts, a P&J Automatic can bring you important savings in time and money by producing these parts in a high-speed, fully automatic cycle. And you'll find that P&J Machines are recognized for their ability to take continuous heavy-duty operation in stride.

Act now. Ask the P&J Representative in your area to recommend a production plan for your specific needs. Or, if you prefer, write direct to Potter & Johnston Company, Pawtucket, Rhode Island.



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . PACKAGING MACHINES

POTTER & JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898

ameter can be precision ground using small carbide rotary files and other special dental type drills.

An auxiliary mounting plate increases the diameter range to include holes up to 5 1/2 inches in diameter. Spindle speeds up to 75,000 rpm can be developed with the standard air turbine. Air turbine and spindle bearings are sealed against dust and dirt. The spindle is carried on high-precision, pre-loaded ball bearings which run in lapped ways.

Circle Item 139 on postcard, page 193

Walker Differential Sine Table and Vacuum Chuck

The O. S. Walker Co., Worcester, Mass., has brought out a differential sine table for vacuum chucks as large as 24 feet long by 10 feet wide. This table is designed to eliminate errors due to deflection when the table is being set to various compound angles. With 34,560 square inches of working surface, the vacuum chuck shown in Fig. 1 is believed to be the largest equipment of this type ever built. The inverted view of the vacuum chuck, Fig. 2, shows the differential micrometer jack-actuating mechanism and manifold piping of the sine table.

The differential sine table is designed for maximum stiffness, initially, but is not dependent on this stiffness to maintain flatness under changing loads and temperature. It is supported at multiple points throughout its area in addition to the main support in the center, which can be either of ball-and-socket or crossed-trunnion construction, according to the basic machine foundation on which it is installed. The center support normally carries somewhat less than half the weight of the table and applied loads.

The major portion of the weight and applied load is distributed over the differential supports. The latter consist of pre-loaded micrometer measuring jacks that are interconnected by a two-drive system. This system provides exactly the correct actuation of each jack in each differential to keep all such points in a uniform plane, regardless of transverse tilt angle, or any combination of angles.

Vertical locking is provided primarily by the irreversible system used in each differential jack, but may be supplemented by electrically interlocked clamps which are also used to provide additional horizontal stability when needed.

Because the irreversible system locking is positive, it is possible to do profiling operations wherein the chuck changes angles during cutting while still maintaining good rigidity in the setup. In such instances, the drive-positioning motors would usually be of servo type tied in with other machine motions. Stepping type motors can also be used for automated setups, with numerical control through punched tape or cards.

Circle Item 140 on postcard, page 193

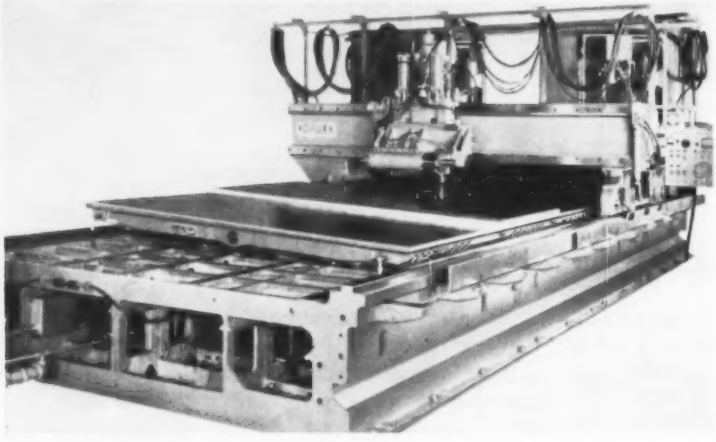


Fig. 1. Walker differential sine table and vacuum chuck for holding aircraft aluminum sheets for precision milling and polishing operations

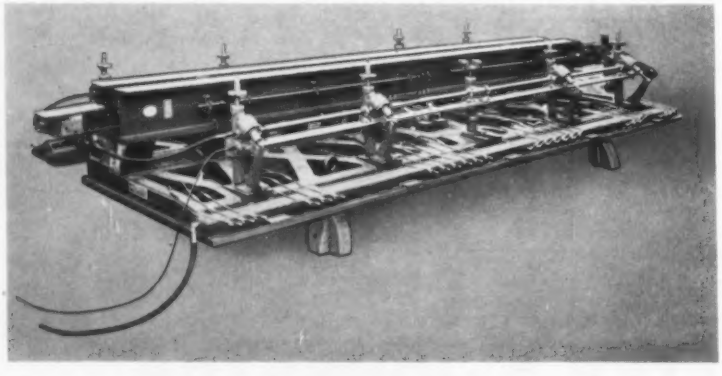
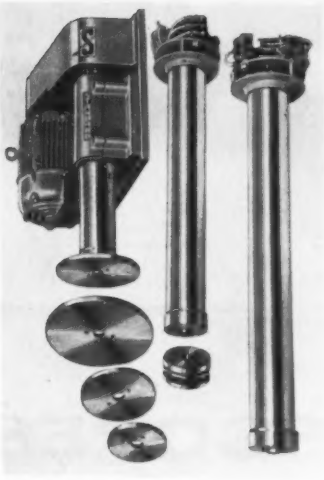


Fig. 2. Inverted view of Walker vacuum chuck showing differential micrometer jack-actuating mechanism and manifold piping

Precision Spindles Made for Electrolytic Metal Removal

Motorized precision spindles designed to meet the requirements of diversified, electrolytic metal removal applications are being produced by the Standard Electrical Tool Co., Cincinnati, Ohio. In addition to direct, motorized spindles to serve 50, 75, 100, 150, 300, 1000, and 3000 ampere power units, self-contained belt-driven motor units of the typical design illustrated are available for individual production applications.

The 5-hp motor unit shown, with changes in ratio of the belt drive, serves the 12-, 18-, and 24-inch extension, interchangeable spindles. Each spindle has a universal type of nose to accommo-



Precision spindles for electrolytic metal removal made by Standard Electrical Tool Co.

date backing plates for 6-, 8-, 10-, 12-, and 14-inch diameter plate-mounted wheels for surface grinding, or independent wheel holders to accommodate wheels for peripheral grinding.

These precision spindles are produced and assembled under controlled laboratory conditions in order to insure maximum precision in the manufacture of a wide range of products, from hypodermic needles and dental burrs to heavy aircraft work in all thermal metals.

Circle Item 141 on postcard, page 193

Surface Illuminator for Scherr Micro-Projector

A surface illuminator for all standard magnifications from 10× to 100× is being introduced by the George Scherr Co., Inc., New York City, for use on the Scherr micro-projector described on page 206 of the November, 1957, number of MACHINERY. This illuminator can be employed wherever a design or contour has to be picked up against an opaque background, or where projection in transmitted light by shadow image is not feasible. It can be used for the inspection of characters in numbering wheels or stamps, the design in punches, graduations on scales, dials or coins, surface characteristics, surface finishes, and similar work requiring projection by reflected light.

The illuminator uses a 500-watt standard projection bulb which gives an extremely distinct image. Light-reflecting mirrors are easily adjustable for all magnifications from 10 to 100×. Colors are faithfully reproduced on the image. This compact surface illuminator readily fits any Scherr micro-projector without any alteration or the use of a fastening device.

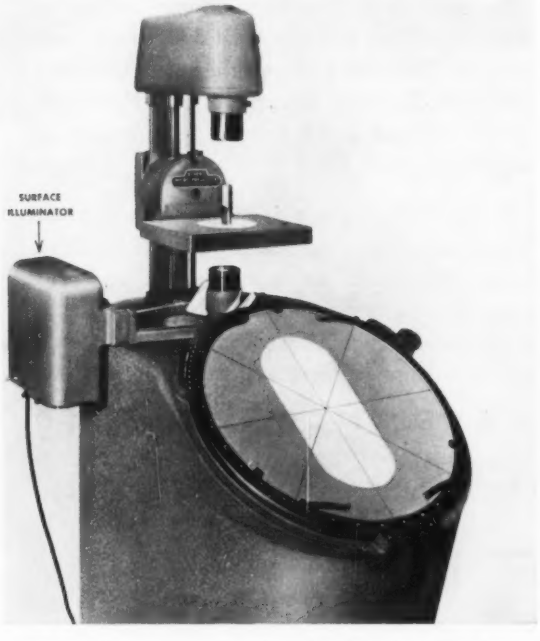
Circle Item 142 on postcard, page 193

Gravity Clarification Unit for Cutting Oils

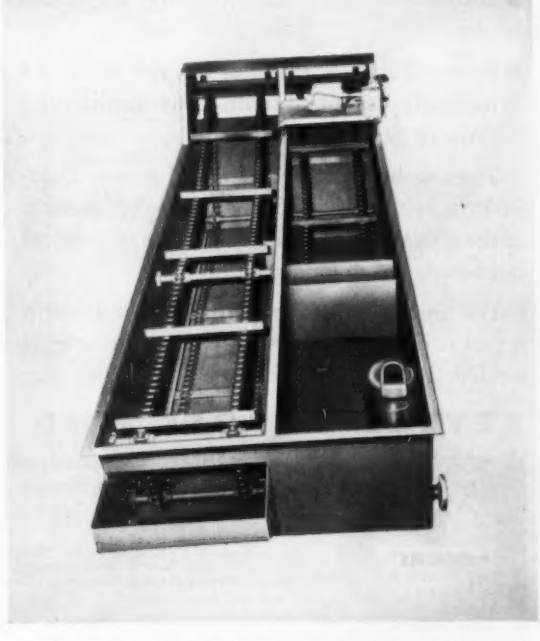
A gravity clarification unit that provides automatic sludge removal from cutting and grinding oils and water-base coolants has been brought out by the Delpark Division, Indiana Commercial Filters Corporation, Lebanon, Ind. Removal of abrasive particles and chips from oils and coolants is achieved by accurate control of the flow velocity of the liquids which permits minimum turbulence and maximum time for gravity action. Retention time for proper settling is 7 to 9 minutes. No filtering media are used, all particle removal being achieved by gravity action. Flow capacities range from 20 to1000 gallons per minute with tank capacities from 140 to 7600 gallons.

Circle Item 143 on postcard, page 193

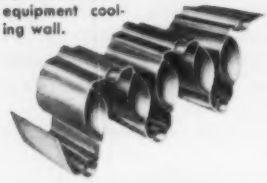
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Scherr micro-projector equipped with surface illuminator



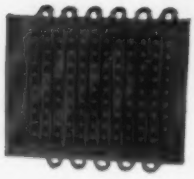
Delpark automatic sludge removal unit for coolants



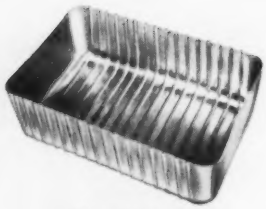
Section of Aluminum Tube-In-Strip combining refrigerant passages with air cooling for electronic equipment cooling wall.



Copper Tube-In-Strip used as a combustion chamber for water heater.



Copper Tube-In-Strip with return bends attached to produce a cooling plate.



This electronic cooling case of Revere Aluminum Tube-In-Strip was inflated after drawing.

REVERE *Tube-In-Strip* SCORES

NOW USED AS WATER-COOLED BUS BAR in manufacture of General Electric Semiconductor Rectifiers

HAS THESE 4 BIG MONEY-SAVING ADVANTAGES

1 Because it is a homogeneous mass Revere Tube-In-Strip eliminates the possibility of leaks.

2 User is able to obtain more efficient cooling.

3 If user finds it necessary to change cells it can be done without draining the system.

4 Revere Tube-In-Strip enables user to have a completely sealed system, thus eliminating O-rings or gaskets.

The use, by General Electric, of Revere Tube-In-Strip as water-cooled bus bar is still another of the myriads of ways this revolutionary product can be applied in industry.

The unique thing about Revere Tube-In-Strip is that it is a solid piece of metal, not two strips welded, brazed or bonded together. You buy strip, fabricate it as you wish, stamping, bending or forming it, and then as a final operation inflation expands the integral channels into tubes. Expanding in the open, the tubes are round; by expanding into dies, the tubes can be made rectangular, fluted, half-round, hexagonal, etc.

Revere Tube-In-Strip saves on first cost, and in fabrication. New and improved designs are made possible. The web between the tubes conducts heat faster. The vastly increased structural strength means you can use lighter gauges, saving in weight and price.

Revere Tube-In-Strip is available in Copper, Copper-base alloys and Aluminum alloys. The Revere Technical Advisory Service and the Research and Development Department will gladly collaborate with you in taking full advantage of this marvelous new material.

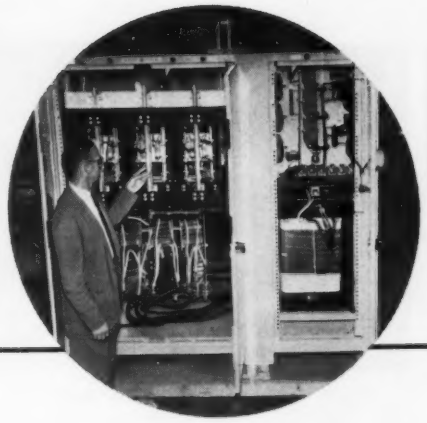
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

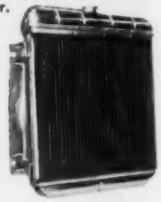
Copper Tube-In-Strip spiral containing both water and refrigerant passages for increased cooling efficiency.







Copper Tube-In-Strip and copper fin assembly for automobile radiator.

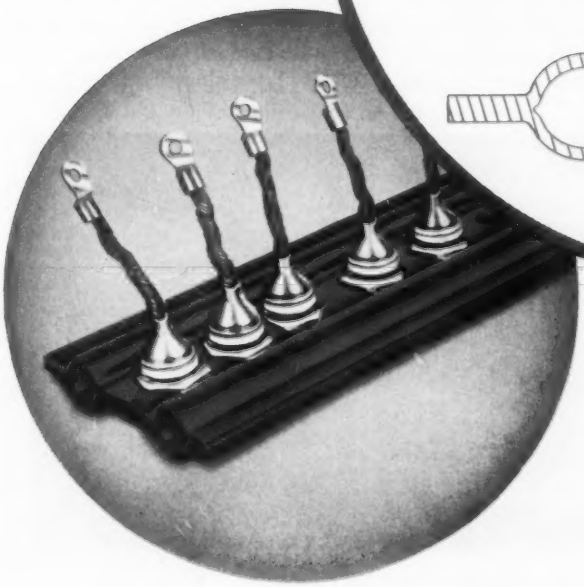


Copper Tube-In-Strip and finned stock assembled and then inflated into automotive air conditioning coil.

ANOTHER TRIUMPH!

PHOTO IN CIRCLE ABOVE SHOWS water-cooled semiconductor power rectifier design with integrally mounted transformer as made by General Electric Company. Rated 150 volts, 4000 amps, d-c, it is used for copper refining.





(Above) **CROSS SECTION** of water-cooled bus, featuring improved cooling method. Dual, leak-proof water passages are formed in solid bus, made from Revere Tube-In-Strip, without the need for welding or brazing. They are located on each side of a section of bus to which silicon cells can be bolted without penetrating the coolant passages.

(Left) **OVERALL VIEW** of new sealed liquid-cooled bus illustrating manner of mounting several silicon rectifier cells. Unique "dry" mounting permits installation of cells without draining liquid from bus. Cells are individually attached to the bus with threaded stud and nut, simplifying the mounting of a cell, and making it unnecessary to disturb any of the other cells on the bus.

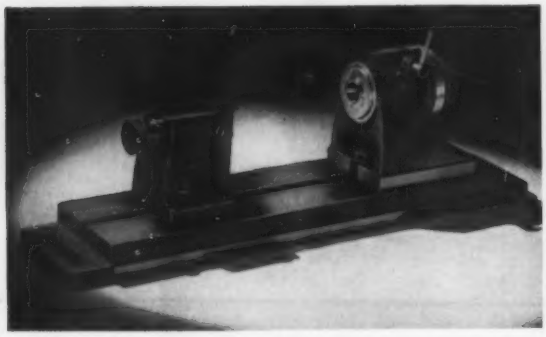


Fig. 1. Hardinge collet index fixture for toolroom and inspection work

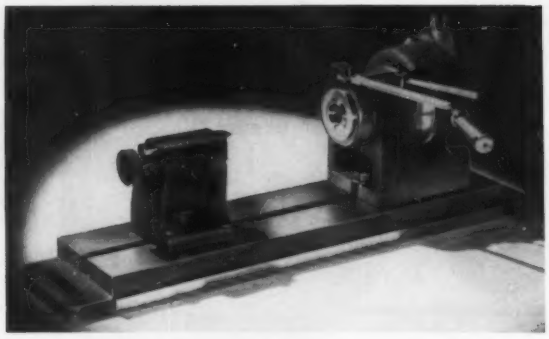


Fig. 2. Collet index fixture for production made by Hardinge Brothers, Inc.

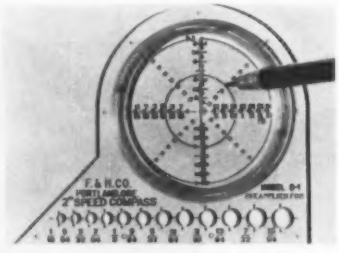
Hardinge Work-Holding and Indexing Fixtures

Collet indexing fixtures for toolroom and production line designed to hold work accurately and provide a means for rapid and economical indexing have been brought out by Hardinge Brothers, Inc., Elmira, N. Y. These units are interchangeable for a wide variety of work, and are designed for direct application, or for use with a sub-base, on milling machines, grinders, shapers, and drill presses. Production fixtures feature a pre-selector index plate that eliminates any chance of mistakes in indexing.

Circle Item 144 on postcard, page 193

Draftsman's Template Compass

The F. & H. Mfg. Co., Portland, Ore., is introducing to the professional and general draftsman two ball-bearing action template compasses. This precision drafting instrument permits the draftsman to draw accurate circles from 1/4 inch to 2 inches in diameter by inserting a pencil or pen in the desired hole in a disc, and spinning the disc around its center. There are additional rows of template holes which afford the draftsman a choice of sixty-nine diameters.



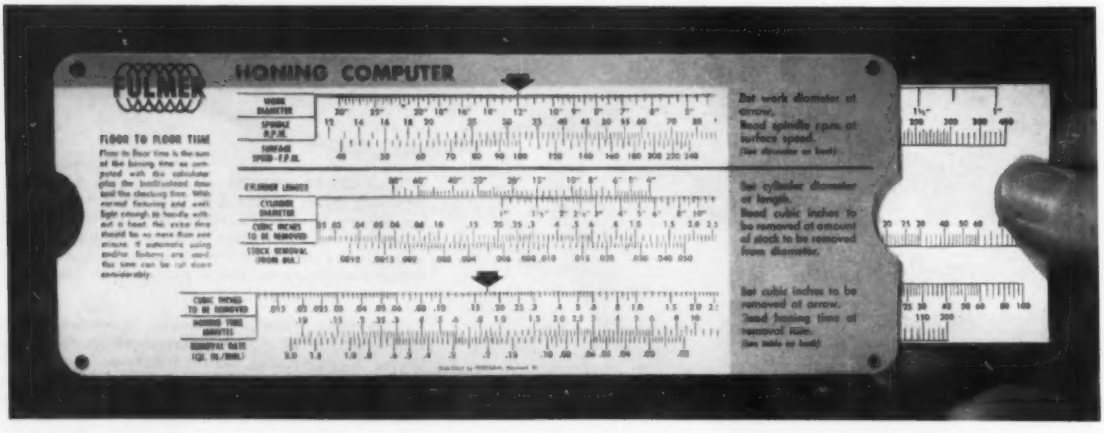
Draftsman's template compass shown by F. & H. Mfg. Co.

The Draftsman's Model illustrated, for use with the drafting pencil or "O" pen, is graduated in 1/32 of an inch. The Student Model for general use with regular pencil is graduated in 1/16 inch. The smooth, ball-bearing action assures accurate circles that are always concentric.

Circle Item 145 on postcard, page 193

Slide-Rule for Solving Honing Problems

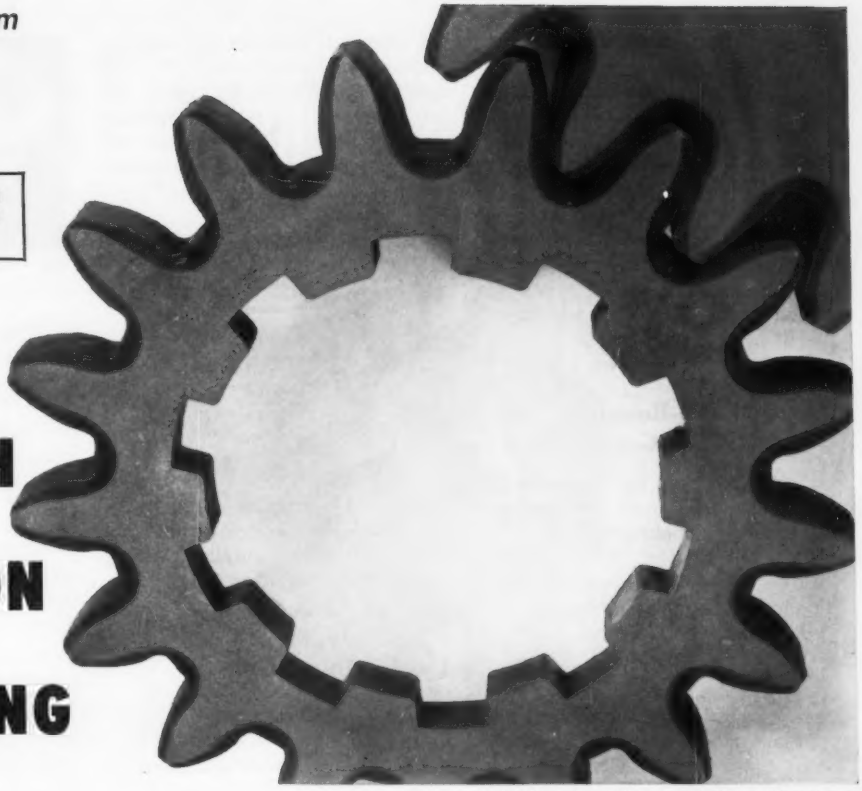
C. Allen Fulmer Co., Cincinnati, Ohio, has designed and copyrighted a honing computer "slide-rule" which is designed for calculating honing times on any size cylinders. It is simplified, accurate, easy to use, and available without cost. It provides instantly necessary information on surface speed, stone selection, approximate metal-removal rates, how much stock to hone, and floor-to-floor time. By making work- and cylinder-diameter settings on the rule it is possible to compute in



Slide-rule for solving honing problems made by C. Allen Fulmer Co.

at Farrel-Birmingham

NEW S&F TOOTH-TO-TOOTH INDUCTION HARDENING



Typical hardening pattern along flanks and through root.

...produces toughest gears yet!

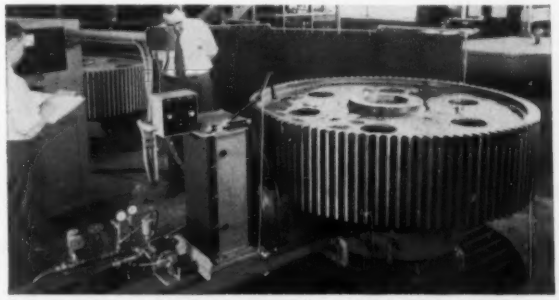
There's nothing like the S & F method of tooth-to-tooth gear hardening. Not only does it add amazing durability to big gears, but load-carrying capacity is vastly increased. Warpage can be insignificant depending on gear design. And there can be substantial savings in material and machining costs!

Farrel-Birmingham tells us that in one installation large gears with S & F induction-hardened teeth have already gone through over two years of rugged service with absolutely no sign of wear—whereas formerly, gears had to be *replaced* every two years. Reports of other installations are also highly satisfactory.

Precision controls maintain constantly accurate time, current, feed and distance between coil and workpiece to assure consistent results. In a group of similar gears, all portions of all teeth will have the same predetermined case contour and depth of hardness. In fact, hardening depth is so accurately controlled and warpage so minute that, for a number of gears, no additional machining is required.

S & F induction hardening units capable of handling gears from 3 in. to 20 ft. in diameter and larger, are available in semi-automatic and automatic models.

Want to know how this revolutionary approach to gear hardening can fit your production? Just ask us about it.



Spur, helical and double helical gears up to 157 in. diameter and 20 in. face widths are induction hardened tooth-by-tooth in this S & F equipment at Farrel-Birmingham, Ansonia, Conn.

KO CO., INC PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

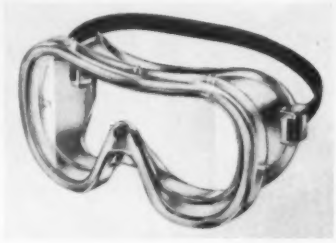
42 Exchange Place, Jersey City 2, New Jersey

advance the honing time in minutes and the stock-removal rate in cubic inches per minute. The rates represent typical performance in most cases and are reasonable for use in estimation of honing time. Additional data may be gathered from this computer as to material used, stone composition with various speeds, cost in comparison with other types of metal removal, and much other pertinent information.

Circle Item 146 on postcard, page 193

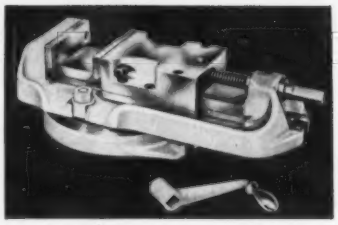
Splash-Resistant Safety Goggle

Safety goggle for protection against splash, spray, and impact exposures announced by the American Optical Co., Southbridge, Mass. This goggle is particularly recommended for use in the chemical industry and where humid conditions prevail. It is indirectly ventilated—no vents in frame or holes in lens for splash-resistant safety. Tests are said to have proved this goggle twice as



fog-free as goggles previously available. The goggle frame is molded from clear vinylite plastic, which is non-irritating.

Circle Item 147 on postcard, page 193



Skinner Chuck

Trough type vise of line offering big opening capacities brought out by the Skinner Chuck Co., New Britain, Conn. These chucks are designed for accurate machining of rough or finished workpieces. They are made in 4-, 5-, 6-, 7-, and 8-inch sizes. The opening capacity of each vise is the same as the width of its jaws. Swivel-bases, which are optional, permit the vises to be set at any angle through a 360-degree circle.

Circle Item 149 on postcard, page 193

Work Drivers Designed to Eliminate Dogs

Setup for grinding the motor end and main bearings of the crankshaft for a Carrier Corporation's hermetic compressor. The crankshaft is held at one end by a work driver developed by the Seneca Falls Machine Co., Seneca Falls, N. Y. Two cylindrical grinders, each equipped with the newly developed work driver, are employed to process the crankshafts. These grinders are said to have reduced direct labor costs by enabling one operator to handle grinding operations on two machines. Actually, the work drivers eliminate conventional driving dogs, and save 6 seconds per piece on an 18-second machine cycle. The work drivers are self-centering, quick-acting and provide a positive drive. Their serrated jaws tighten automatically on the work—the harder the pull, the tighter the grip. The work drivers may be used on any type of engine lathe, multiple tool lathe, and plain or universal grinders for work ranging from 1/4 inch to 6 7/8 inches in diameter.

Circle Item 148 on postcard, page 193



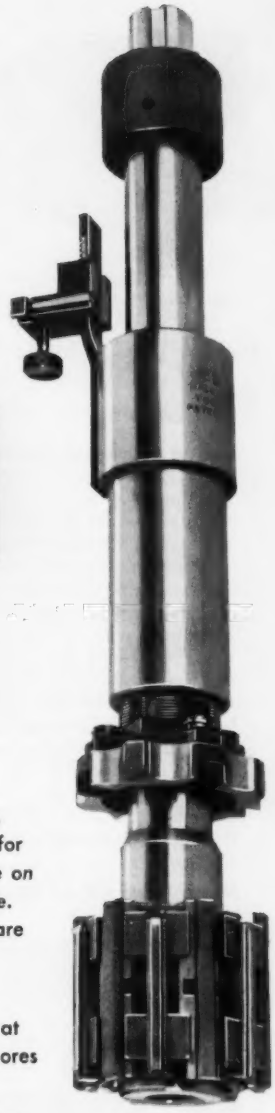


Reliance Sleeve-Bearing Motor

Sleeve bearing of design employed in line of motors from 3/4 through 15 hp announced by Reliance Electric & Engineerng Co., Cleveland, Ohio. These polyphase motors, built especially for quiet operation in air-conditioning and pumping applications, are available in all standard enclosures for use on all standard NEMA voltages from 208 through 550 volts. These motors feature a "Liquimatic" bearing design which employs "Permawick," a patented fluid-fiber material. The material combines with oil to form a fluid mass that is extruded into the bearing cavity.

Circle Item 150 on postcard, page 193

FACTS about JES-CAL SIZE CONTROL HONING TOOLS



▶ The Jes-Cal honing tool is the most compact, combined hone equipment which has produced uniform size and accuracy consistently and dependably.

▶ Jes-Cal honing tools contain all size control elements. They function independently of the machine, and consistently show overall savings in comparative tooling, machine and operating costs.

▶ The Jes-Cal size control gage, with carbide contact points is long wearing—usually up to one or two years in high production without replacement. It operates entirely independently of friction, it has eliminated all trouble in gaging control.







▶ The Jes-Cal size control taper gage, shown above, is easily and quickly set for pre-selective desired change in final size on *the tool without removal from the spindle.* Adjustment increments of 0.00025-inch are all mechanical—positive—dependable.

▶ Jes-Cal honing tools have been successfully operated in high production at twice former conventional speeds on bores in steel parts.

▶ It has been demonstrated that the full potential advantages of Jes-Cal honing tools cannot be completely developed on most presently used machines; that heavier, all-mechanical machines may be preferable for lower cost production.

▶ For 1960 programs, Jes-Cal is accelerating completion of a much heavier, single spindle, all-mechanically operated honing machine to assure new operating and production advantages.

▶ Jes-Cal honing tools have met—or evidenced their capacity to meet—the requirements desired by leading manufacturers for higher quality, cost-cutting production.



For further information, write to:

JES-CAL COMPANY

31485 GROESBECK HIGHWAY • FRASER, MICHIGAN

By E. S. Salichs

BETWEEN GRINDS

Skyscooping

The director of the scientific laboratory for the Ford Motor Co., and member of a ten-man committee for instrumentation of United States satellites, Dr. Michael Ference, Jr., in a speech recently said: "Consider only the weather possibilities of a space station. An Aerobee-Hi rocket, equipped with a camera, brought back photos of a hurricane formation not yet detected by conventional means. Imagine, then, the detailed weather forecasts that would be available if man had a permanent station in space, orbiting around the earth." Imagine, too, the detailed ribbing of local weathermen should their predictions not come true!

Max. Weight of Model being Reduced

"Reducing at $500 a Week," a feminine reporter's story in *Look*, described the daily, rigid reducing routine at an Arizona health farm. She duly noted that most of the women taking this expensive treatment were "the wives of men who owned oil wells or heavy-machinery companies." Since it is ungallant to assume that heavy-machinery men like solidity in their wives as well as in their machines, our alternate conclusion is that the ladies are forced to provide heavy meals to match the machines.

D-Day

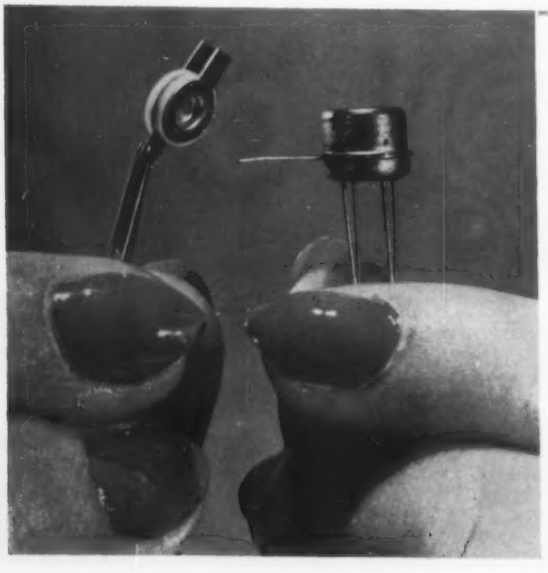
The old hassle about whether to raise or lower the office windows is fast disappearing with the adoption of air-conditioning. But the temperature can still be a sore spot. So *The Clarkson Letter* tells of a company which appeased all complaints by installing dummy thermostats in each office department so that clerks could "control" the temperature in their own work areas. But what happens when the Dastardly Deceit is Discovered?

Machine Takes Floor

An electronic instrument, "Selvox," with a vocabulary of thirty-two words, spoke from punched keys to stockholders of the Hoffman Electronics Corporation at their annual meeting held recently. Then the president explained that because a coded electronic signal is simpler to transmit than voice, and because it is much less affected by interference or static, the instrument made by the corporation holds promise for application in solving problems in aircraft, ground, point-to-point, and shipboard communications. The stockholders got the word, or words.

Mum was the Word

Faced with a shortage of raw paper-making material during Civil War days, one Maine mill operator used wrappings stripped from mummies imported by the shipload from Egypt, a pungent piece of information we got from *Bindery Talk*.



MUCH SMALLER—than a fingernail and not much larger than a shirt button (which evidently couldn't be found) is this miniature electron tube (left) developed at the General Electric Research Laboratory. The new design is the latest in a series of developments that has brought the electron tube, once bulky and fragile in its glass envelope, down to the size of its competitor, the transistor (right). The new vacuum tube can operate at temperatures in the 900- to 1500-degree F. range, but contains no heater, all the heat necessary being provided by its environment. The design is still in the laboratory stage, no tubes being commercially available at this time.

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Wind shields for 120-mm shells die-cast with Cromo-High V tool steel

Each piece has to be virtually perfect when you're die-casting aluminum wind shields for 120-mm shells. Tooling up for a job like this calls for a hot-work steel that will turn out high-quality castings and at the same time keep production costs low.

Bethlehem has several grades of hot-work tool steel which could be considered for such a highly specialized application.



The die caster weighed all the facts with Bethlehem's local tool steel distributor. Together, they came up with an excellent tool steel for jobs of this sort—Cromo-High V.

Cromo-High V is our 5 pct chrome-moly hot-work tool steel, containing 1 pct vanadium. A grade that has proved its stubborn resistance to wash and erosion, it also has the stamina for long runs.

Cromo-High V is uniformly annealed for easy machining. It has good center density and grain refinement, and is free from porosity. And there's little chance of cleavage cracking when adequate radii are used in the die, and the steel is properly heat treated.

A trial run with Cromo-High V is the best way to learn how good a tool steel it really is. Your local Bethlehem tool steel distributor either has it in stock, or can get it delivered to you quickly.

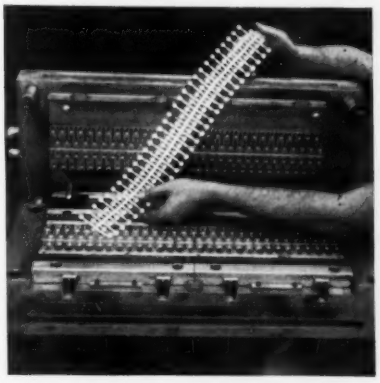


BETHLEHEM TOOL STEEL ENGINEER SAYS:

Air-quenching means longer service life for hot-work tools

Most hot-work tool steels can be hardened by quenching in oil or air. Because of convenience in handling, and to avoid excessive scale, it is often preferable to quench some hot-work tools in oil. However, air-quenching is considered better practice, for it produces lower residual stresses than when tools are liquid-quenched. Since heat-check failures develop from surface stresses which are produced in service, the presence of residual stresses in the tool can lead to premature failure.

Tools having low residual stresses are best suited for long service on hot-work applications. That's why air-quenching is usually best for hot-work tools.



Plastic Beads Molded with Duramold B

Here is an injection mold, with 120 cavities, used by R. A. Koegl Stamp & Die Works, Inc., Hillside, N. J., to produce Plastic Poppit Beads. The steel was supplied by Ackerlind Steel Co., Inc., N. Y. Duramold B is our oil-hardening chromium type of plastic-molding die steel, containing an addition of boron. Its annealed hardness of 100 max Brinell assures ease in cold-hobbing and its alloy content gives it high core strength.

News OF THE INDUSTRY

California

ALLEN MFG. Co. of Hartford, Conn., has opened a new branch warehouse in Los Angeles, Calif. The new Allen facility is located at 6935 1/2 E. Bandini Blvd., that city. Teletype call number is TWX: MTB-7313. Distributors in Arizona, California, Nevada, Oregon, Utah, and Washington are asked to send all standard stock orders to the new Los Angeles warehouse, but orders for "specials" should be sent to the factory at Hartford 1, Conn.

BERNARD A. SHEDDEN has been appointed factory representative on the West Coast, for OPTICAL GAGING PRODUCTS, INC., Rochester, N.Y., with permanent residence in San Francisco, Calif. Mr. Shedden will work directly with OGP distributors J. C. FLETCHER Co. of San Francisco and PAUL B. SLATER Co. of Los Angeles. He will also be available through H. F. SODERLING Co. of Seattle for special work in the Northwest.

INDUSTRIAL PRODUCTS DIVISION of Western Gear Corporation, Lynwood, Calif., has moved from this locality to be headquartered in the future at the Belmont plant of the company. This plant is located near San Francisco, with the mailing address P. O. Box 126, Belmont, Calif. ED JENKS has become marketing manager of the Industrial Products Division.

ROBERT B. BROWN, staff assistant of Food Machinery and Chemical Corporation's organization planning and market-research group in San Jose, Calif., has been promoted to manager of market research for the company's Peerless Pump Division with headquarters in Los Angeles.

ROBERT W. TITGEMEYER has been named branch manager of the Los Angeles territory by the Carpenter Steel Co., Reading, Pa.

Illinois, Indiana, and Wisconsin

E. L. ESSLEY MACHINERY Co., Chicago, Ill., has been appointed mid-central area sales representative for Niles industrial and railroad machine tools made by Hamilton Division, Hamilton, Ohio, of Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. The Essley sales territory includes northern Illinois, Iowa, Wisconsin, western Michigan, and northern Indiana. Essley headquarters are at 565 W. Washington Blvd., Chicago.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces a realignment of sales personnel. Named to head the aluminum sales department is L. PAUL LEE, who has been manager of stainless steel sales. He will continue in the latter capacity. NORMAN LYNCH was assigned to the aluminum sales desk in the General Order Department.

THE CAPEWELL MANUFACTURING Co., Hartford, Conn., announces the opening of new and expanded office and warehouse facilities at 3050 North Cicero Ave., Chicago 41, Ill. The operation will be under the supervision of BRUCE S. WILLIAMS, who assumes the post of district manager in the Chicago-Detroit territory.

JAMES A. PERHAM, of the Thor Power Tool Co.'s Aurora, Ill., Works, has been named chief engineer of Thor Power Tool Co.'s SpeedWay Mfg. Co. Division at LaGrange Park, Ill. Mr. Perham has been with the Thor engineering organization since 1937.



James E. Perham, chief engineer, Thor SpeedWay Mfg. Co.

A. A. MILKIE has been appointed manager of the Chicago District, Pangborn Corporation, Hagerstown, Md. Mr. Milkie will direct Pangborn's extensive field engineering service and staff of sales personnel. His headquarters will be at 2435 N. Halstead St., Chicago, Ill.

THOMAS H. THORESEN has been appointed field sales manager for Hannifin Co., Des Plaines, Ill., a division of Parker-Hannifin Corporation.

MICHAEL J. MCCAUGHEY has been appointed general sales manager of the Tuthill Pump Co., Chicago, Ill.

RANSBURG ELECTRO-COATING CORPORATION, Indianapolis, Ind., moved into its new building at 3939 W. 56th St., that city, as part of a million and a half dollar expansion and building program for research and development, sales, service, and production.

GISHOLT MACHINE Co., Madison, Wis., announced that it has acquired United States distribution rights to the line of CRI-DAN high-speed, semi-automatic, single-point threading machines.

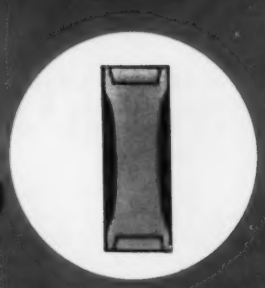
Michigan and Missouri

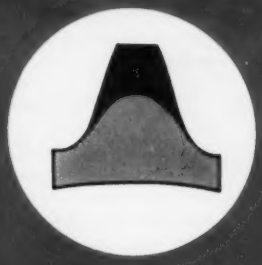
HOOVER BALL & BEARING Co., Ann Arbor, Mich., announces the following administrative changes: the election of WILLIAM C. LIGHTHALL as a vice-president of Uniloy, Inc., a wholly-owned subsidiary of the Hoover Ball & Bearing Co.; the appointment of ROBERT C. RESSLER, vice-president, to the position of general manager, Ball and Bearing Division; and the appointment of JAMES C. CARMAN as assistant general manager of the Ball and Bearing Division.

In a move designed to greatly expand production facilities and services, the Marine and Industrial Division, CHRYSLER CORPORATION, Detroit, Mich., will relocate its entire operation. New headquarters will be



NEW CINCINNATI
flamatic®











save either way

on precision selective surface heating

Take your selective surface hardening, heating and brazing problems to Cincinnati—builders of new and versatile flame and induction heating machines. Whether your work is on high production quantities or small lots of different size parts, you can get the hardness you want, where you want it, using the heat source and method most economical for you.

For detailed information, write for catalogs on the Inductron, M-1993, or the Flamatic, M-2015, or better still—call in a Meta-Dynamics Division field engineer. Backed by the resources of Cincinnati's completely staffed and equipped heat engineering laboratories, your needs will be analyzed, your parts "test run" and specific recommendations made.



NEW CINCINNATI
inductron®

CINCINNATI

flamatic and inductron
hardening machines

Meta-Dynamics Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

at 12200 E. Jefferson Ave. in Detroit. Production is slated to be in full swing at the new location in December.

KENNAMETAL INC., Latrobe, Pa., will be represented by GIL BUNN SALES in Saginaw, Mich., and the surrounding area. GILBERT A. BUNN formed the new organization after fourteen years with Kennametal. JAMES B. ANDERSEN has been appointed supervisor for the Detroit district, assisting T. J. KNIFF, district manager.

The A. C. HABERKORN MACHINERY CO., Detroit, Mich., has been appointed as distributor for the eastern half of Michigan and the four northern counties of Ohio for the complete line of the Hydraulic Press Mfg. Co., a division of Koehring Co., Mt. Gilead, Ohio.

THE MOTCH & MERRYWEATHER MACHINERY CO., Detroit, Mich., has been appointed distributor for the eastern Michigan area by Sidney Machine Tool Co., Sidney, Ohio, for Sidney products.

LATROBE STEEL CO., Latrobe, Pa. has announced it will open a new branch office in St. Louis, Mo. FREDERICK E. ALLISON, JR., will head the St. Louis office. It will serve Missouri, Kansas, southern Illinois, northern Arkansas, and Oklahoma.

New England

CUTTING TOOL DIVISION, Brown & Sharpe Mfg. Co., Providence, R. I., announces the following appointments: WILLIAM P. SHEFFIELD will assume new duties as assistant to the general manager. Mr. Sheffield was formerly superintendent of the High Speed Steel Group and FRANK E. MONTIE will succeed him in that capacity. Other appointments are: T. RUSSELL HALL to assistant superintendent, High Speed Steel Group; PATRICK G. LINDEMANN to department foreman of the machining sections, and DIMITRI YASINCZUK to supervisor of Quotation Section for high speed steel cutting tools.

SHELDON E. YOUNG has been elected executive vice-president of the Barrymount Corporation, wholly owned subsidiary of Barry Controls, Inc., Watertown, Mass. The Barrymount sales force has its headquarters in Chicago, and newly established branch sales offices in Detroit, Mich., and Dayton, Ohio.

NORMAN H. HOLLAND has been appointed sales manager, Athol Division, Union Twist Drill Co., Athol, Mass. Mr. Holland will be in charge of all sales, distribution, advertising, and warehousing activities covering all metal-cutting tools manufactured at and distributed from Athol, where he will make his headquarters.

BAY STATE ABRASIVE PRODUCTS Co., Westboro, Mass., announces its removal to 105 Maple St., that city, to larger and better-equipped quarters. The company also has assigned JAMES A. CLOUTIER to the northern Indiana territory to work out of the Chicago sales organization.

PRATT & WHITNEY CO., INC., West Hartford, Conn., announced the following personnel changes. ALBERT M. DEXTER has been named director of metrology at the company. Mr. Dexter will direct all activities that have to do with the science of measurement in the Gage Division. He recently completed a fourteen month assignment with the National Bureau of Standards, working on research projects to devise means to accurately measure one-tenth of a millionth of an inch. ALFORD H. JOHNSON has been appointed sales manager for the Cutting Tool and Gage Division of the company. WILLIAM C. MULLIN will manage instrument gage sales for the entire country, reporting to Mr. Johnson. CHRYSOSTOM B. BLANCHARD has been appointed superintendent of the Gage Division of Pratt & Whitney.



Alford H. Johnson, sales manager, Cutting Tool and Gage Division, Pratt & Whitney Co., Inc.





(Left) William P. Sheffield, assistant to the general manager, Cutting Tool Division and (right) Frank E. Montie, superintendent, High Speed Steel Group, Brown & Sharpe Mfg. Co.

New York and New Jersey

NARDA ULTRASONICS CORPORATION, Westbury, N. Y., announces recent additions to its organization of distributors and representatives in the ultrasonic industry. Distributors of Narda equipment in the United States are the Dot Line Co., national distributor to the fishline manufacturing industry; Walgren & Co., cleaning, plating, and metal-finishing supplier in Michigan; A. C. Fricke Co., supplying general industry in Texas; and Robert Lavers Co., covering the metropolitan New York area in the machine tool industry. Morris-Cunningham Associates, Indianapolis, Ind., cover that state for Narda.

HOWARD S. GLEASON has been named manager of Stromberg-Carlson's Electronic Control Systems plant in Los Angeles, Calif. Mr. Gleason will continue as assistant general manager of the Electronics

(Continued on page 224)

T-J spacemaker cylinder

Quality Engineered

to give quality results

with Extras . . . at No Extra Cost!



You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—offers, exclusively, many extras . . . that are STANDARD, AT NO EXTRA COST!

Designed to eliminate tie-rods, providing greater strength . . . saves space . . . reduces manhours and costs in all push-pull-lift operations. IMMEDIATE SHIPMENT in a wide range of styles and capacities, with 64,000 combinations. Write for Bulletin SM 155-3 with complete engineering details. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
HYDRAULIC, AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHERS

METAL PISTON ROD SCRAPER . . . Standard at No Extra Cost!

NEW "SUPER" CUSHION FOR AIR . . . Standard at No Extra Cost!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . Standard at No Extra Cost!

ONE PIECE PISTON . . . Standard at No Extra Cost!

NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . Standard at No Extra Cost!

NO TIE-RODS TO STRETCH . . . Standard at No Extra Cost!

STREAMLINED DESIGN . . . Oil Pressure to 750 P.S.I.—air to 200 P.S.I. Standard at No Extra Cost!

FORGED SOLID STEEL HEADS . . . Standard at No Extra Cost!

HARD GEAR HONING

CURRENT RESULTS

The following records are taken from current gear honing operations to show how some of the troublesome hazards of gear manufacturing are overcome by honing.

WHAT HONING ACCOMPLISHED

GEAR "A"

A lead error of .0008" was reduced to .0001"

GEAR "B"

Runout was improved .0020"

GEAR "C"

Notable improvement in both surface finish and in amount of tooth kickout

GEAR "D"

Variation in involute form improved .0002"

GEAR "E"

Size over pins reduced .004" and all nicks removed. Essentially a salvage job

THESE ARE THE GEARS BEING HONED

Gear	No. Teeth	Pitch Dia.	Rockwell "C"	Stock Removed	TIME	
					Honing	Floor to Floor
"A" INTERNAL	83	5.7832	58-63	.0015	40 sec.	70 sec.
"B" PLANET PINION	15	.790	56	.0005	27 sec.	31 sec.
"C" REAR SUN GEAR	45	2.3726	54	.0006	30 sec.	34 sec.
"D" REAR SUN GEAR	45	2.508	58	.001	24 sec.	30 sec.
"E" SPUR GEAR	46	6.000	60	.004		3 min. 25 sec.

NOTE: Hone Life, Gear "B"—6000 to 8500 pieces
Gear "C"—3000 to 4000 pieces

Write for Bulletin H-57-2



SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

8098

Basic Thread Dimensions and Tap Drill Information

Fractional Sizes — American National Form

(Continued)

1	2	3	4	5	6	7
Nominal Size	Basic* Major Diameter Inches	Basic* Pitch Diameter Inches	Basic Minor Diameter Inches	Maximum* Minor Diameter Class 1B, 2B & 3B Internal Thd.	Tap Drill	
					Size Drill to Produce Approx. 75% Basic Thd. Engagement	Decimal† Equivalent of Drill
1 3/8– 6	1.3750	1.2667	1.1585	1.2146	1 7/32	1.2187
8	1.3750	1.2938	1.2126	1.2547	1 1/4	1.2500
12	1.3750	1.3209	1.2668	1.2948	1 19/64	1.2969
16	1.3750	1.3344	1.2938	1.3158	1 5/16	1.3125
18	1.3750	1.3389	1.3028	1.3230	1 5/16	1.3125
1 7/16–12	1.4375	1.3834	1.3293	1.3573	1 23/64	1.3594
16	1.4375	1.3969	1.3563	1.3783	1 3/8	1.3750
18	1.4375	1.4014	1.3653	1.3855	1 3/8	1.3750
1 1/2– 6	1.5000	1.3917	1.2835	1.3396	1 11/32	1.3437
8	1.5000	1.4188	1.3376	1.3797	1 3/8	1.3750
12	1.5000	1.4459	1.3918	1.4198	1 37/64	1.4219
16	1.5000	1.4594	1.4188	1.4408	1 7/16	1.4375
18	1.5000	1.4639	1.4278	1.4480	1 7/16	1.4375
1 9/16–16	1.5625	1.5219	1.4813	1.5033	1 1/2	1.5000
18	1.5625	1.5264	1.4903	1.5105	1 1/2	1.5000
1 5/8–5½	1.6250	1.5069	1.3888	1.4582	1 29/64	1.4531
8	1.6250	1.5438	1.4626	1.5047	1 1/2	1.5000
12	1.6250	1.5709	1.5168	1.5448	1 35/64	1.5469
16	1.6250	1.5844	1.5438	1.5658	1 9/16	1.5625
18	1.6250	1.5889	1.5528	1.5730	1 9/16	1.5625
1 11/16–16	1.6875	1.6469	1.6063	1.6283	1 5/8	1.6250
18	1.6875	1.6514	1.6153	1.6355	1 5/8	1.6250
1 3/4– 5	1.7500	1.6201	1.4902	1.5575	1 9/16	1.5625
8	1.7500	1.6688	1.5876	1.6297	1 5/8	1.6250
12	1.7500	1.6959	1.6418	1.6698	1 43/64	1.6719
16	1.7500	1.7094	1.6688	1.6908	1 11/16	1.6875
1 13/16–16	1.8125	1.7719	1.7313	1.7533	1 3/4	1.7500
1 7/8– 5	1.8750	1.7451	1.6152	1.6885	1 11/16	1.6875
8	1.8750	1.7938	1.7126	1.7547	1 3/4	1.7500
12	1.8750	1.8209	1.7668	1.7948	....	1.7938‡
16	1.8750	1.8344	1.7938	1.8158	1 13/16	1.8125
1 15/16–16	1.9375	1.8969	1.8563	1.8783	1 7/8	1.8750
2 –4½	2.0000	1.8557	1.7113	1.7861	1 25/32	1.7812
8	2.0000	1.9188	1.8376	1.8797	1 7/8	1.8750
12	2.0000	1.9459	1.8918	1.9198	....	1.9188‡
16	2.0000	1.9594	1.9188	1.9408	1 15/16	1.9375
2 1/16–16	2.0625	2.0219	1.9813	2.0033	2	2.0000
2 1/8–4½	2.1250	1.9807	1.8363	1.9144	1 29/32	1.9062
8	2.1250	2.0438	1.9626	2.0047	2	2.0000
12	2.1250	2.0709	2.0168	2.0448	....	2.0438‡
16	2.1250	2.0844	2.0438	2.0658	2 1/16	2.0625
2 3/16–16	2.1875	2.1469	2.1063	2.1283	2 1/8	2.1250
2 1/4–4½	2.2500	2.1057	1.9613	2.0361	2 1/32	2.0312
8	2.2500	2.1688	2.0876	2.1297	2 1/8	2.1250
12	2.2500	2.1959	2.1418	2.1698	....	2.1688‡
16	2.2500	2.2094	2.1688	2.1908	2 3/16	2.1875

*Figures shown in columns 2, 3 and 5 are correct for Unified Thread Form as computed in American Standard Publication A.S.A. B1.1-1949.

†75% thread is rarely needed in small diameters. Use of a larger drill will reduce tap breakage.

‡Theoretical Minor Diameter of Nut equivalent to 75% basic thread engagement. Drill sizes are omitted in all thread sizes where a standard drill is not available.

(Concluded on following page)

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Basic Thread Dimensions and Tap Drill Information

Fractional Sizes — American National Form

(Concluded)

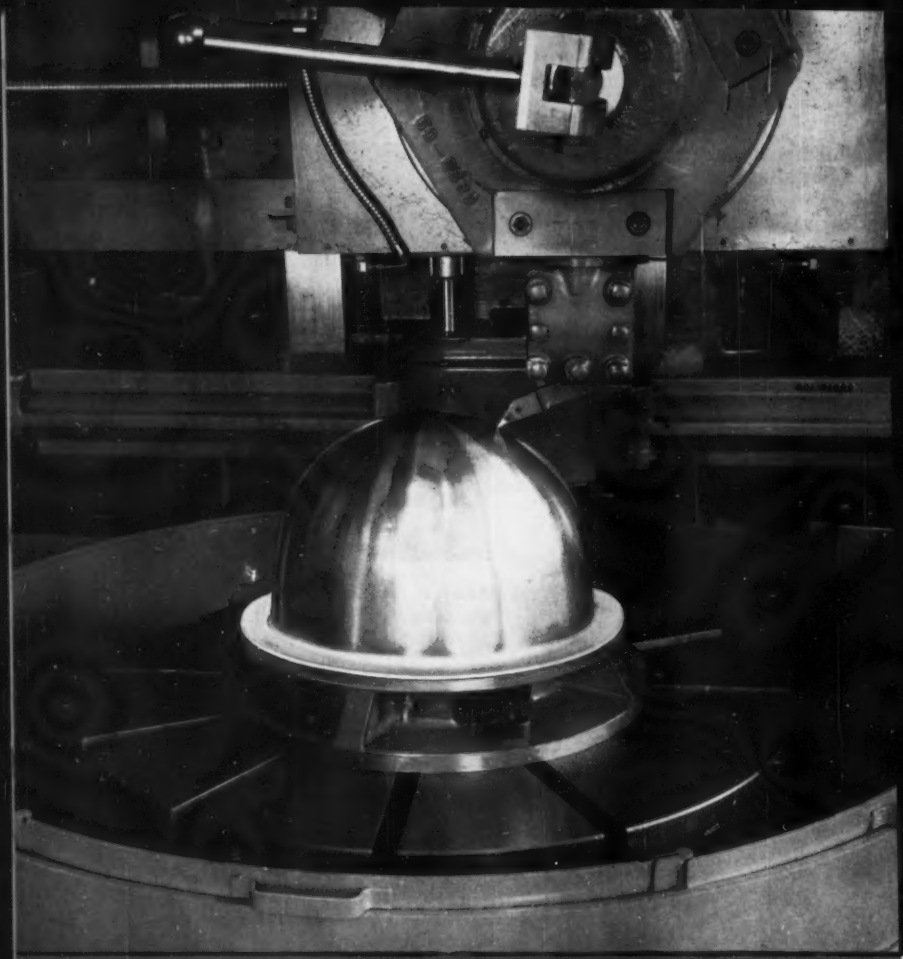
1	2	3	4	5	6	7
					Tap Drill	
Nominal Size	Basic* Major Diameter Inches	Basic* Pitch Diameter Inches	Basic Minor Diameter Inches	Maximum* Minor Diameter Class 1B, 2B & 3B Internal Thd.	Size Drill to Produce Approx. 75% Basic Thd. Engagement	Decimal† Equivalent of Drill
2 5/16–16	2.3125	2.2719	2.2313	2.2533	2 1/4	2.2500
2 3/8– 4	2.3750	2.2126	2.0502	2.1344	2 1/8	2.1250
12	2.3750	2.3209	2.2668	2.2948	....	2.2938‡
16	2.3750	2.3344	2.2938	2.3158	2 5/16	2.3125
2 7/16–16	2.4375	2.3969	2.3563	2.3416	2 3/8	2.3750
2 1/2– 4	2.5000	2.3376	2.1752	2.2594	2 1/4	2.2500
8	2.5000	2.4188	2.3376	2.3797	2 3/8	2.3750
12	2.5000	2.4459	2.3918	2.4198	....	2.4188‡
16	2.5000	2.4594	2.4188	2.4408	2 7/16	2.4375
2 5/8–12	2.6250	2.5709	2.5168	2.5448	....	2.5438‡
16	2.6250	2.5844	2.5438	2.5658	2 9/16	2.5625
2 3/4– 4	2.7500	2.5876	2.4252	2.5094	2 1/2	2.5000
8	2.7500	2.6688	2.5876	2.6297	2 5/8	2.6250
12	2.7500	2.6959	2.6418	2.6698	....	2.6688‡
16	2.7500	2.7094	2.6688	2.6908	2 11/16	2.6875
2 7/8–12	2.8750	2.8209	2.7668	2.7948	....	2.7938‡
16	2.8750	2.8344	2.7938	2.8158	2 13/16	2.8125
3 – 4	3.0000	2.8376	2.6752	2.7594	2 3/4	2.7500
8	3.0000	2.9188	2.8376	2.8797	2 7/8	2.8750
12	3.0000	2.9459	2.8918	2.9198	....	2.9188‡
16	3.0000	2.9594	2.9188	2.9408	2 15/16	2.9375
3 1/8–12	3.1250	3.0709	3.0168	3.0448	....	3.0438‡
16	3.1250	3.0844	3.0438	3.0658	3 1/16	3.0625
3 1/4– 4	3.2500	3.0876	2.9252	3.0094	3	3.0000
8	3.2500	3.1688	3.0876	3.1297	3 1/8	3.1250
12	3.2500	3.1959	3.1418	3.1698	....	3.1688‡
16	3.2500	3.2094	3.1688	3.1908	3 3/16	3.1875
3 3/8–12	3.3750	3.3209	3.2668	3.2948	....	3.2938‡
16	3.3750	3.3344	3.2938	3.3158	3 5/16	3.3125
3 1/2– 4	3.5000	3.3376	3.1752	3.2594	3 1/4	3.2500
8	3.5000	3.4188	3.3376	3.3797	3 3/8	3.3750
12	3.5000	3.4459	3.3918	3.4198	....	3.4188‡
16	3.5000	3.4594	3.4188	3.4408	3 7/16	3.4375
3 5/8–12	3.6250	3.5709	3.5168	3.5448	....	3.5438‡
16	3.6250	3.5844	3.5438	3.5658	....	3.5641‡
3 3/4– 4	3.7500	3.5876	3.4252	3.5094	3 1/2	3.5000
8	3.7500	3.6688	3.5876	3.6297	....	3.6282‡
12	3.7500	3.6959	3.6418	3.6698	....	3.6688‡
16	3.7500	3.7094	3.6686	3.6908	....	3.6891‡
3 7/8–12	3.8750	3.8209	3.7669	3.7948	....	3.7938‡
16	3.8750	3.8344	3.7938	3.8158	....	3.8141‡
4 – 4	4.0000	3.8376	3.6752	3.7594	....	3.7564‡
8	4.0000	3.9188	3.8376	3.8797	....	3.8782‡
12	4.0000	3.9459	3.8918	3.9198	....	3.9188‡
16	4.0000	3.9594	3.9188	3.9408	....	3.9391‡

*Figures shown in columns 2, 3 and 5 are correct for Unified Thread Form as computed in American Standard Publication A.S.A. B1.1-1949.

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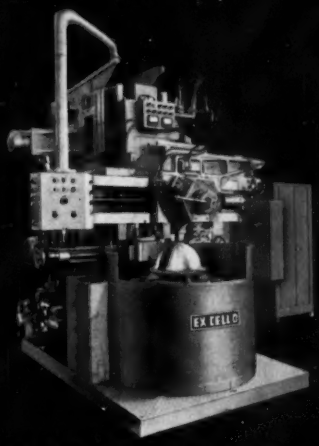
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XLO

EX-CELL-O FOR PRECISION

LEFT: Single tracer-controlled tool contours aluminum forging to .080" wall thickness holding .001" tolerance inside and outside.



ABOVE: Compact Vertical Contouring Machine handles medium or large workpieces. Slim cabinet at right side holds electronic tracer controls.

Critical Contour Tolerances?

HOLDS WITHIN .001' OF TRUE CONTOUR—INSIDE AND OUT



Close-up shows Style 416 contouring the inside surface. Workpiece is held in a vacuum fixture mounted on the machine table.

58-7

Contouring within .001" of true contour—inside and out—*without waste* requires the kind of precision built into an Ex-Cell-O Style 416 Vertical Contouring Machine.

The aluminum forging illustrated was first contoured on its periphery with a single electronic-tracer-controlled tool, then precision-finished inside to .080" wall thickness.

Designed for contouring hemispherical or irregularly-shaped surfaces, Ex-Cell-O Style 416 Machines also face, bore, turn, groove and chamfer with automatic cycling between loading and unloading.

Call your local Ex-Cell-O Representative, or write directly to Ex-Cell-O for information on other Precision Vertical Boring Machines.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Division. Stromberg-Carlson is a division of General Dynamics Corporation. At the same time, the marketing activities of Electronic Control Systems will come under the direction of the Electronics Division in Rochester.

THE CARLSON CO., Oceanside, N. Y., announces that it has purchased the entire Reicherter Elasticometer Spring Tester inventory from the TESTING EQUIPMENT CO. of 15 William Street, New York 5, N. Y. It has acquired the right to use the name "Testing Equipment Co." but prefers to use its present name. The entire inventory has been transferred to its new building in Oceanside.

PIC DESIGN CORPORATION, subsidiary of Benrus Watch Co., Inc., East Rockaway, N. Y., has built a new extension to its present building. In February 1958, PIC Design Corporation purchased the entire inventory and sales rights to the "VON" tool component line. This inventory is stocked and sold directly from the new building.

EUSTACE LINGLE has been named vice-president in charge of industrial sales and education for Oakite Products, Inc., New York City.

JAMES C. DARBY has been appointed general sales manager for the TRUARC RETAINING RINGS DIVISION of Waldes Kohinoor, Inc., Long Island City, N. Y. In his new position, Mr. Darby will be responsible for the sales and marketing of all products manufactured by the Truarc Division.



James C. Darby, general sales manager, Truarc Retaining Rings Division, Waldes Kohinoor, Inc.

ROBERT P. GEHRING has been appointed sales manager of the Cayuga Machine & Fabricating Co., Inc., Depew, N. Y. Mr. Gehring is a former chairman of the Niagara section of the American Welding Society and director of the Saginaw Valley section.

WILLIAM F. OSWALT has been named general manager of the Direct Current Motor and Generator Department, General Electric Co., Erie, Pa. Since 1953 Mr. Oswalt has been general manager of the General Purpose Control Department in Bloomington, Ill.



A. E. Carter, newly elected vice-president, manufacturing, Worthington Corporation

A. E. CARTER of Ann Arbor, Mich., has been elected vice-president of manufacturing, Worthington Corporation, Harrison, N. J. Mr. Carter will succeed LESLIE C. RICKETS, who is relinquishing this position in order to devote full time to his increased responsibilities as group vice-president of five Worthington operating divisions located in New Jersey and Massachusetts.

Ohio

BAKER BROTHERS, INC., Toledo, Ohio, have bought the Detroit Screwmatic 750 line from Gear Grinding Machine Co., Detroit, Mich. The name of the high-capacity machine will be changed to "Baker Automatic Bar Machine." Among the personnel transferring to Baker Brothers are JOHN BROPHY, ROBERT RACK, and CHARLES CAGNON. Mr. Brophy will continue in charge of sales.



Albert H. Dall, newly appointed chief engineer, Machine Tool Division, Cincinnati Milling Machine Co.

ALBERT H. DALL was appointed chief engineer of the Machine Tool Division, Cincinnati Milling Machine Co., Cincinnati, Ohio. His new position involves coordination of all engineering activities of the Milling Machine, Grinding Machine, Electro-Hydraulics and Special Machine Tool Divisions. In addition, he is responsible for the Development Research Laboratory.

The FRANK S. RANZ CO., Cincinnati, Ohio, announces the appointment of D. M. MILLHOLLAND in the capacity of machine tool sales engineer. Mr. Millholland will be handling the company's Indiana accounts as well as assisting in Cincinnati.

CHESTER L. WELLS has been appointed manager of the American Society for Metals' metal expositions ("Metal Shows"). Mr. Wells succeeds the late William H. Eisenman as head of the annual National Metal Show. The Society's national headquarters are at 7301 Euclid Ave., Cleveland 3, Ohio.

CLEVELAND TRAMRAIL DIVISION, Cleveland Crane & Engineering Co., Wickliffe, Ohio, announces the following appointments: WILLIAM P. HANKS as Midwest District manager and ROBERT M. UNDERWOOD, Northeast District manager of the Division.

THE OSBORN MANUFACTURING Co., Cleveland, Ohio, has appointed R. M. DRAPER to the position of manager, New York office. Mr. Draper has been affiliated with the company since 1930, serving it in many capacities.

E. C. De Vault has been appointed Toledo district sales engineer for the Press Division of E. W. Bliss Co., Canton, Ohio. Mr. De Vault joined Bliss in 1940, serving the company in many capacities. Mr. De Vault's office will be located at the E. W. Bliss Co.'s Toledo, Ohio, plant at 1420 Hastings Street.

Koehler Aircraft Products Co., Dayton, Ohio, has announced three executive promotions. Donald J. MacFadgen is promoted to vice-president, engineering; Harold A. Herkenhine becomes chief engineer; and George Foster, vice-president, west coast operations.

Pennsylvania

United States Steel Corporation, Pittsburgh, Pa., has installed a new metallurgical testing laboratory at its Duquesne, Pa., Works. Steels produced at Duquesne Works and tested in this laboratory are used in a wide range of applications and include steels used in manned aircraft and guided missiles, nuclear reactor vessels, electric power generators, ball and roller bearings, television-transmission towers, automotive gears and axles, and in other applications where steel is subjected to extreme operating conditions.

Firth Sterling, Inc., Pittsburgh, Pa., has announced the following appointments to its sales organization: Kenneth E. McKown, a sales representative in the Pittsburgh District sales, will also cover the Buffalo, Rochester, and Elmira territory. Robert B. Ahart has been appointed to the Southwest District and will represent Firth Sterling in the Dallas, Tex., area. Robert C. Wilkison has been assigned to the Southern District to cover the Florida, Georgia, and South Carolina territory.

Sunbeam Equipment Corporation, Meadville, Pa., a newly formed subsidiary of Sunbeam Corporation, Chicago, Ill., has purchased most of the assets formerly used by the Industrial Furnace Division of Westinghouse Electric Corporation, including the design and engineering files, equipment, and production facilities at Meadville, Pa. Sunbeam-Stewart Furnace Division will be transferred from Chicago to the new subsidiary and continued in the Meadville plant.

Firth Sterling, Inc., Pittsburgh, Pa., announces the promotion of J. Mabon Childs and Stephen F. Madden to assistant managers, Steel Sales Division. Mr. Childs will continue to manage the sale of zirconium alloys. Mr. Madden will be in charge of tool and die steel sales, and will continue in his present capacity as metallurgical engineer.

Lindberg Engineering Co. and Lindberg Industrial Corporation, Chicago, Ill., announce the appointment of Lester A. Shea as district sales manager of the Pennsylvania office located at 345 Mount Lebanon Blvd., Pittsburgh 34, Pa. A. C. Whitaker has also joined Lindberg Engineering Co. as sales engineer and will operate out of the Pittsburgh office.

Crucible Steel Company of America, Pittsburgh, Pa., has advanced two veteran employes to new positions in the Metallurgy Division of its Technology Department. E. T. Walton has been named manager—customer technical services. James A. Kearney has been appointed manager—materials and processes.

Edward P. Geary was elected to the board of directors of the Vanadium-Alloys Steel Co., Latrobe, Pa. Mr. Geary is president of Vanadium-Alloys Steel Canada, Ltd., located in London, Ontario.

Landis Tool Co., Waynesboro, Pa., announces the following promotions: Walter P. Lotz has been appointed vice-president in charge of sales. John A. Cover has been promoted to sales manager. John J. Keane has been promoted to assistant sales manager.

Zagar, Inc., Cleveland, Ohio, has announced the opening of a district office at 7114 Rising Sun Ave., Philadelphia, Pa. The manager is Harry Hutter.

National Forge & Ordnance Co., Irvine, Pa., has announced that the company will now be known as National Forge Co.

James R. Parr has been appointed vice-president and chief engineer of American Industries Co., Bristol, Pa.

Carl K. Dellmuth was named a director of Standard Pressed Steel Co., Jenkintown, Pa.

Virginia and Florida

William R. Comber was appointed manager of Reynolds Metals Co., Richmond, Va.—aluminum extrusion plant located in Grand Rapids, Mich.

Adam H. Killermann, 144 N.W. 16th St., Delray Beach, Fla., will join the sales organization of Bay State Abrasive Products Co., Westboro, Mass., in the Southern District with specific responsibility for sales in the state of Florida.

Frank H. Erdman has been named president of Kett Technical Center, Inc., Pompano Beach, Fla., research and development center of U. S. Industries, Inc., New York City.

Coming Events

September 29-October 3—American Society of Tool Engineers' Semi-Annual Meeting and Western Tool Show will be held at Shrine Exposition Hall, Los Angeles, Calif. Exposition committee: Leonard Abrams, ASTE, 10700 Puritan Ave., Detroit 38, Mich.; Harry E. Conrad, executive secretary.

October 16-17—Thirty-fourth annual meeting of American Machine Tool Distributors Association to be held at the Sheraton Plaza Hotel, Boston, Mass. For further information, contact Thomas A. Fernley, Jr., executive secretary, American Machine Tool Distributors Association, 1900 Arch St., Philadelphia 3, Pa.

October 27-29 — Semi-annual meeting of American Gear Manufacturers' Association at the Edgewater Beach Hotel, Chicago, Ill. For further information contact Association Headquarters, One Thomas Circle, Washington 5, D. C.

October 27-31 — National Metal Exposition and Congress will be held at the Cleveland Public Auditorium, Cleveland, Ohio. The same week the annual meeting of the American Society for Metals, the Society for Nondestructive Testing, and the American Institute of Mining, Metallurgical, and Petroleum Engineers—Institute of Metals Division will be held. For further information contact American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Adolph O. Schaefer, secretary.

December 1-5—Twenty-Third Exposition of Power and Mechanical Engineering will be held at the Coliseum, New York City. For further information, contact International Exposition Co., 480 Lexington Ave., New York 17, N. Y. E. K. Stevens, manager.

New Books and Publications

ENGINEERING MATERIALS HANDBOOK. Prepared by a staff of specialists. Charles L. Mantell, Editor. 1936 pages; 648 illustrations. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $21.50.

Engineering materials are tied in very closely to specifications, tests, standards, and the like in this new and completely up-to-date volume. A comprehensive and authoritative reference, it considers materials from the viewpoint of engineering structures, machinery, and equipment. Gathered together in this one volume is the kind of information required by anyone concerned with planning design, structure, manufacturing, and serviceability.

In forty-three carefully organized sections, the handbook covers metals, the organic and inorganic materials, and the cause and prevention of failure in materials. Technical tables, design information, structural characteristics, and tabular data make a wealth of useful and specific facts quickly available. A high degree of reliability is achieved by coordinating the work of more than 150 contributors, each a specialist in his own field.

BUSINESS INVESTMENT POLICY. By George Terborgh. 260 pages; 8 1/2 by 11 inches; numerous tables and graphs. Published by the Machinery and Allied Products Institute, 1200 Eighteenth St., N.W., Washington 6, D. C. Price, $8 to MAPI member companies and $10 to non-members.

This study and manual is the result of a research project launched two years ago to bring the MAPI formula for equipment replacement up-to-date. The book consists of four parts. Part I contains an introductory, or background, discussion. Part II develops the theory of the new MAPI system. Part III details the instructions for its application, with examples. Part IV considers some problems of top management.

The investment formula simplifies the number of estimates and stipulations the business analyst is called on to make. For example, in a relatively simple investment proposal such as the acquisition of a new machine, many questions arise. What improvement will it make currently in the annual operating results of the business? How long will it be useful to the business, and what will it bring on disposal? How intensively will it be used over this period? How will its operating costs change as time goes on? How will its service deteriorate? What is the tax depreciation method? What will be the cost of deferring the disposal of existing equipment that would be displaced by the proposed machine? And so forth . . .

MOTION AND TIME STUDY, Fourth Edition. By Ralph M. Barnes. 665 pages; illustrated; 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $9.25.

In this new revised edition, Dr. Barnes adheres to his original purpose of presenting the basic principles that underlie the successful application of motion and time study. He supplies practical examples of each.

Five new chapters deal with: motion study, mechanization, and automation; mechanized time study and electronic data processing; systems of motion-time data; work sampling; evaluating and controlling factors other than labor, and multiple-factor wage incentive plans.

The book includes new material on developments in the industrial use of pulse rate as an index of physical activity. The section on time study is enlarged by new material on statistical procedures in time study and information on auditing of methods, time, standards, and wage incentive plans. All known systems of motion data are outlined and four of these systems are described in detail, including complete tables of motion-time data for each.

FINE BORING AND TURNING. By W. Boneham (No. 43 in Yellow Back Series). 68 pages; illustrated; 5 1/8 by 8 1/2 inches. Published by Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents.

This handbook is a reference of Fine Boring and Turning, a comparatively recent machining operation developed about the year 1928. There are three chapters, covering Basic Principles; Cutting Tools, Feeds and Speeds, and Coolants; as well as Fixture Design and Fine-Boring Applications. Fine Boring and Turning lends itself to mass production or the production of small quantities in a variety of components.

ESTIMATING MACHINING COSTS. By C. W. S. Parsons, Instructor in Industrial Engineering, California State Polytechnic College, San Luis Obispo. 400 pages; 6 by 9 inches; illustrated. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $8.

This is a new guide to making satisfactory estimates of the costs of machine tool operations. It is planned to show the reader how to study the engineering drawing of a particular work-piece and decide how it can be made; to make a breakdown analysis of the necessary operations and their elemental subdivisions, considering men, materials, tooling, and machines; and to put time and money values on the various factors contributing to the completion of the work.

The cost estimator's job is analyzed as well. Other fundamentals are covered in a discussion of the relation of cost estimating to engineering, and of such basic factors as tool life, machinability, and cutting-tool materials.

AMERICAN DRAFTING STANDARDS MANUAL. Section 3—Projections, ASA Y14.3-1957, 11 pages. Section 6—Screw Threads, ASA Y14.6-1957, 18 pages; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 30th St., New York 18, N. Y. Price, $1.50 each.

These booklets are part of a series comprising the American Drafting Standards Manual, to supersede American Standard Drawings and Drafting Room Practice, Z14.1-1946. Section 3-Projections discusses Representational Drawing in all of its aspects. Section 6-Screw Threads presents information about the design, specifications, and dimensioning of the same. Both booklets are illustrated with line drawings.

METAL CUTTING TOOL NOMENCLATURE. 107 pages; illustrated; 8 1/2 by 11 inches. Published by Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price, $4.50.

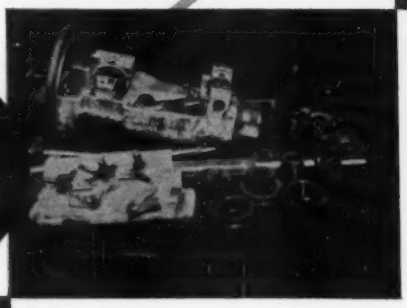
The Metal Cutting Tool Institute's new booklet—Metal Cutting Tool

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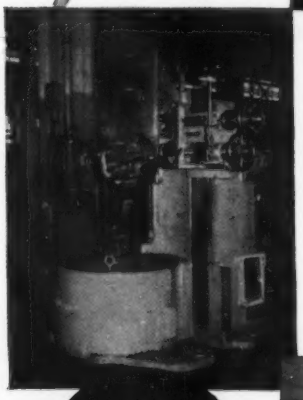
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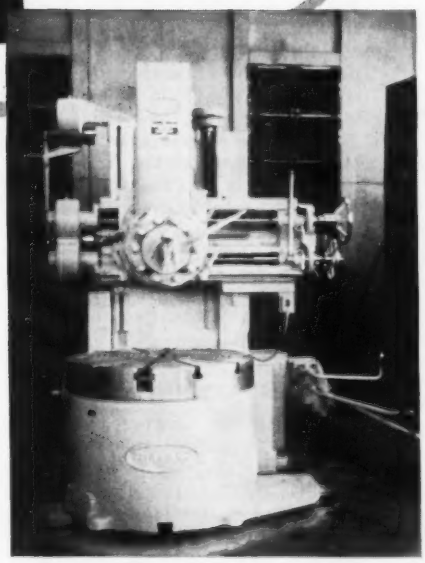
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Nomenclature—provides an authoritative, well-illustrated source of definitions and nomenclature pertaining to various classes of cutting tools. Included is nomenclature relating to twist drills and combined drills and countersinks; reamers; counterbores and spot-facers; taps; dies; thread chasers; milling cutters; hobs; gear-shaper cutters; gear-shaving cutters; and broaches.

This booklet should help to eliminate some of the confusion and loss of time due to misinterpretation of the meaning of specifications concerning cutting tools.

ASME HANDBOOK-METALS ENGINEERING—PROCESSES. Edited by Roger W. Bolz. 428 pages; illustrated; 7 1/2 by 10 inches. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $13.50.

In this handbook engineers will find detailed data on the various processes by which metals are converted into finished products. Composed of forty-five sections, the book covers such areas as the heat-treatment of steel, casting, hot-working, cold-working, powder metallurgy, welding and cutting, machining, finishing, and electroforming.

Illustrated with hundreds of charts, illustrations, and other aids, the book covers scores of production methods: die-casting, hot-forming, bending, press-working, cold-heading, thread-rolling, metal spinning, flame cutting, welding, cleaning, buffing, and many more.

Reviews of Available Motion Pictures

AUTOMATING ELECTRICALLY

A new, two-part industrial film program has been announced by the General Electric Co., Schenectady, N. Y. Elements of the program, "Automating Electrically," are a thirty-minute color motion picture and a forty-four-page manual. "Automation and Mr. Halstead" is the second movie on the subject of automation produced in connection with the company's "More Power to America" program. The first such film was released early in 1956 under the title "This Is Automation."

Building flexibility into automated processes by exploiting recent advances in the electrical field is a major point made in the first-mentioned film and the manual. Recent electrical developments in ten functional areas—power converting, power actuating, sensing, data presenting, regulating, data converting, data storing, programming, computing, communicating—are outlined in the manual, "The Impact of Electrical Progress on Your Automation Planning." Examples of automation demonstrating growing capabilities of electrical equipment and systems include descriptions of a new, program-controlled milling machine which achieves profitable automation on runs of only two identical pieces.

PRODUCTION BAND-SAW MACHINING

"Tooling the Band Saw for Production" is the title of a color motion picture brought out by the DoALL Co., Des Plaines, Ill., that describes the versatility of the band saw in the accurate removal of metal. It shows a new concept to the machining of parts requiring shaping, slotting, splitting, or facing. Slotting of hydraulic pump rotors with the aid of a simple indexing fixture for moderate production is shown, as well as elaborate fixtures for automatic operation.

Another film recently announced by DoALL, entitled "A Production Cut-Off Band Saw," features the company's 24-inch, heavy-duty Model 24 power saw. The movie shows how cost-reducing methods are applied to basic cut-off operations by using a 2-inch wide, high-speed steel saw band to cut large billets, rails, bars, and structurals. The machine is shown cutting various alloys, and cutting rates and other pertinent data are given. In 16-millimeter sound and color, the film has a running time of approximately ten minutes. Both of these motion pictures are available on free loan from the DoALL Co., Des Plaines, Ill.

BROACHING FUNDAMENTALS

Designed for viewing by engineers, a 16-millimeter color-sound film just released by the Lapointe Machine Tool Co. is said to be the first to illustrate the fundamentals of modern broaching. It runs for thirty minutes. This motion picture starts out by showing the operation of simple, basic broaching machines and continues on to the most intricate, fully automatic high-production machines. Close-up views of tools and fixtures make it easy for the viewer to understand the simplicity of the process.

The film is available without charge, with or without a Lapointe engineer to answer questions after the showing, to companies and organizations. Inquiries should be addressed to the Director of Educational Program, Lapointe Machine Tool Co., Hudson, Mass.

HYDRAULIC OILS

A twenty-five-minute, sound and color motion picture recently released by the Texas Co. illustrates the discovery and industrial applications of hydraulic laws, and demonstrates the part premium oils play in hydraulics today. In the film, the essential idea of Pascal's Laws is depicted with a glass model of a basic power system. The characteristics and important properties of premium hydraulic oils and their effectiveness are also discussed. How the performance obtained from premium hydraulic oils depends on a few simple precautions is explained in the closing minutes of the movie. Requests for this film, entitled "Hydraulic Oils," should be addressed to the Texas Co., 135 E. 42nd St., New York 17, N. Y.

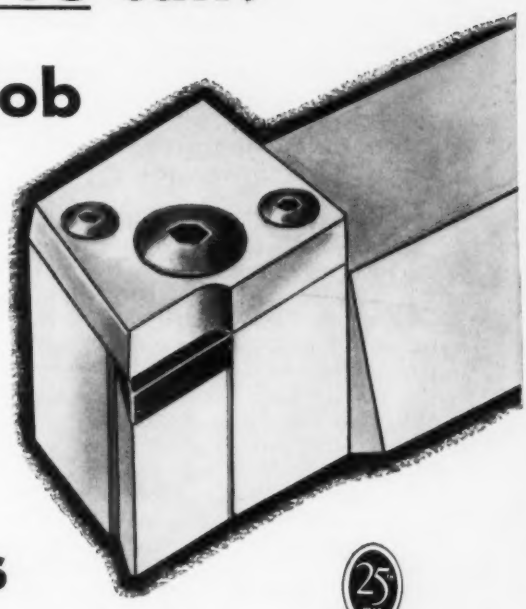
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Increased Use of Titanium Allows for Aircraft Fasteners

Fasteners made of titanium alloy are now being used in the aircraft industry at an estimated rate of twenty million yearly. Heavier steel fasteners are being replaced as the result of a study made by Northrop Aircraft, Inc., Hawthorne, Calif., for the Air Materiel Command. The twenty-million estimate is a substantial increase over the one million titanium and titanium-alloy fasteners that were being used in the industry when the study was started in 1955.

Evaluation of the use of titanium alloys in screws, bolts, and rivets, indicates a fastener weight reduction of approximately 35 per cent per aircraft. In addition, better heat- and corrosion-resistant properties, and a better strength-to-weight ratio for the fasteners, are obtained.

Nobody can cut steel better than you can! Any cutting job is easier when you rely on V-R carbides





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Sharpening and Maintenance of Carbide Reamers

The importance and economy of resharpening metal-cutting tools before they are excessively dulled has been stressed repeatedly. This precaution is particularly applicable to carbide reamers. In order to maintain size and finish, they must not only be resharpened at the proper time, but it must be done correctly. The following suggestions by the National Twist Drill & Tool Co., Rochester, Mich., will be found of value in carbide-reamer maintenance.

Resharpen chamfers before the corners are noticeably dull, and particularly before any measurable wear occurs on the periphery of the reamer. Before resharpening, make sure the centers in the reamer are in good condition. Lap these centers, if necessary. Mount the reamer on centers in the sharpening machine and make sure that the machine centers are in good condition too. Check the diamond wheel to make sure it runs true and without wobble. Use a cylindrical wheel rather than a cup-wheel. A 6-inch diameter wheel with narrow face (1/16 to 1/8 inch) and 220 grit is generally satisfactory.

Set the tooth rest at the proper distance below the center to produce the desired relief on the chamfer. The amount of primary relief should vary with the diameter of the reamer, and should be approximately as follows:

Reamer Diameter, Inches	*Primary Relief, Degrees*	*Secondary Relief, Degrees*
1/4	20	40
3/8	15	30
1/2	12	25
3/4	10	20
1	8	16
1 1/2 and larger	6	12

A chamfer angle of 45 degrees is satisfactory for the majority of reamers. The width of chamfer will vary from around 0.015 inch for a small diameter reamer to 3/32 inch or more on one of a large diameter. In all cases, the chamfer must be deeper than the amount of stock to be removed. If the reamer shows signs of roughness or pick-up on the periphery, it should be reconditioned by lapping. A bronze bushing about 3/4 inch long with a 1/16-inch wall thickness, and with its bore machined to fit the reamer, is split obliquely and used for the lap. A lapping compound consisting of No. 4 or No. 5 diamond powder and olive oil is recommended. The reamer should be mounted in a suitable speed lathe and rotated backwards when lapping.

If the cutting edges on the periphery of the reamer begin to round over from dulling, they can often be reconditioned by grinding the faces of the carbide tips. This should be done with a 20-degree, concave-face cup-wheel of about 220-grain size. Start grinding with the wheel touching first at the bottom of the tip, so that the minimum stock necessary is removed at the cutting edges. Special types of chamfers, leads, and other modifications for particular applications or materials are sometimes used to advantage on carbide reamers, but these will necessarily vary from one job to another.

Boring-Bar Holder

Daniel Love, Manager
Elbee Mfg. Co., Worcester, Mass.

A boring-bar holder which we made in our shop and have been using successfully for several years is shown in the accompanying illustration. It consists of a cast block and eccentrically bored sleeve. The block and sleeve are slotted to permit a firm clamping grip to be obtained on the boring-bar by tightening the nuts on the two bolts which secure the holder to the tool-block.



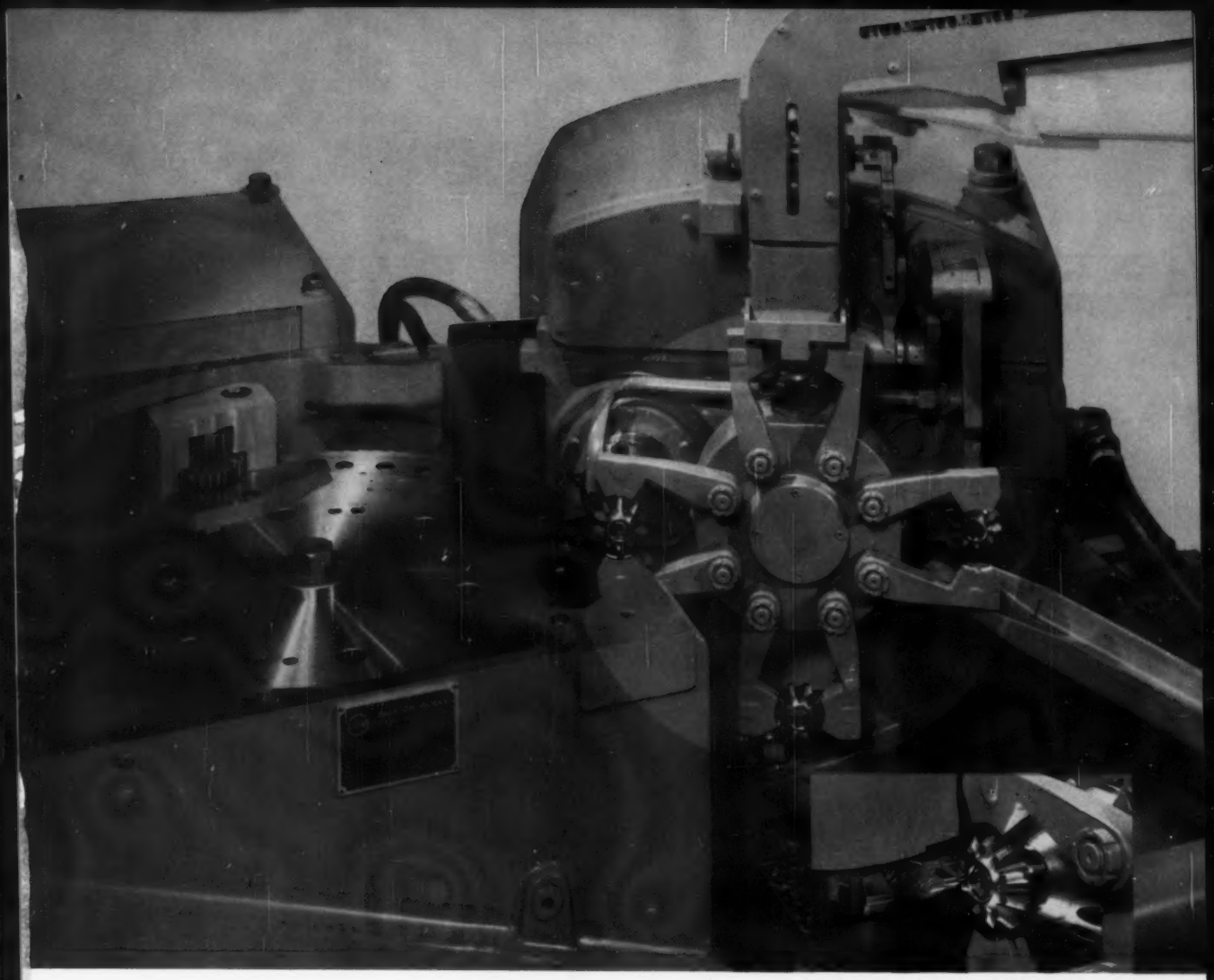
Boring-bar holder with vertical adjustment.

The sleeve is bored 5/16 inch off center to permit a rise and fall adjustment of 5/8 inch for the boring-bar by simply rotating the split sleeve. The boring-bar remains parallel with the lathe bed and in alignment with the longitudinal travel movement of the carriage throughout the 5/8-inch range of vertical or rise and fall adjustment. This is an important feature when boring small holes.

By simply turning the bar over and reversing the tool bit, the bar can be used for turning work of any diameter up to the full capacity of the lathe. This permits turning work that is too large to swing over the saddle.

* * *

Scientists at Westinghouse have recently discovered a class of materials which can convert the heat of a burning fuel, or other high-temperature source of heat, directly into electricity.



In Revacycle Method each blade of cutter is longer than its predecessor; there is no depthwise feed of cutter itself. One rotation of the cutter completes each tooth from the solid.

Fastest way yet to cut straight bevel gears

If you're looking for a faster, fully automatic way to cut straight bevel gears and pinions with conjugate surfaces and localized tooth bearings, consider the Gleason No. 109 Straight Bevel Revacycle® Machine.

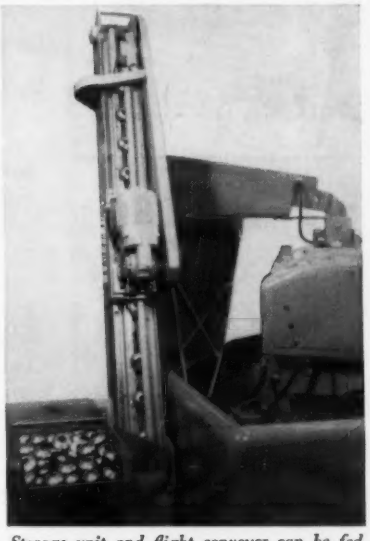
You rough, semifinish, and finish a gear from the solid blank with a single rotation of the Revacycle cutter.

Now both 21″ and 25″ diameter cutters can be used on the No. 109 Revacycle Machine. The 25″ cutter cuts gears to a maximum depth of 0.600″. The 21″ cutter will cut to a maximum of 0.400″.

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The No. 109 Machine handles a wide range of automotive and farm machinery gears: up to 10″ diameter, 5:1 ratio, 1¼″ face width.

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To find headings easily, look for capital letters at top of each page to denote location.

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Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.

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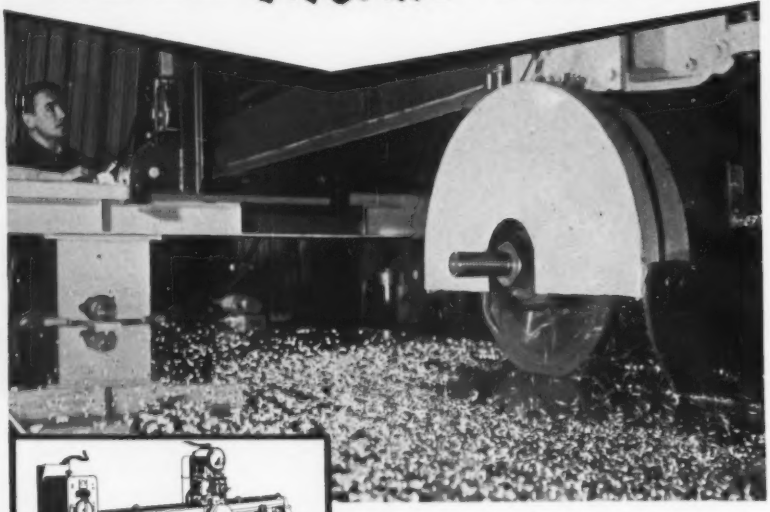
ABRASIVES, Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

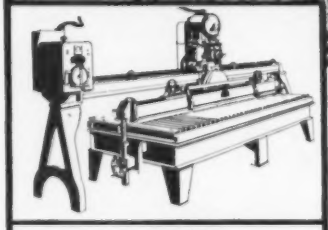
ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

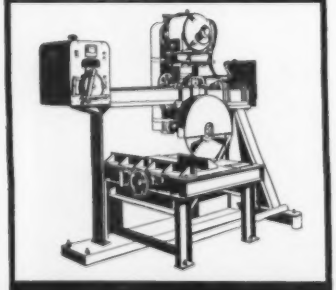
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Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
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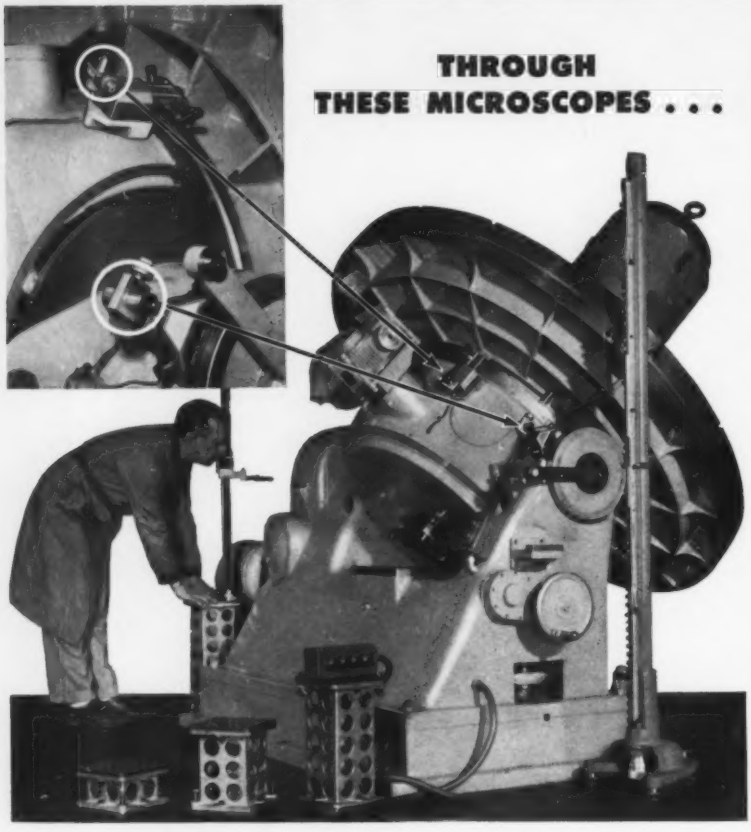
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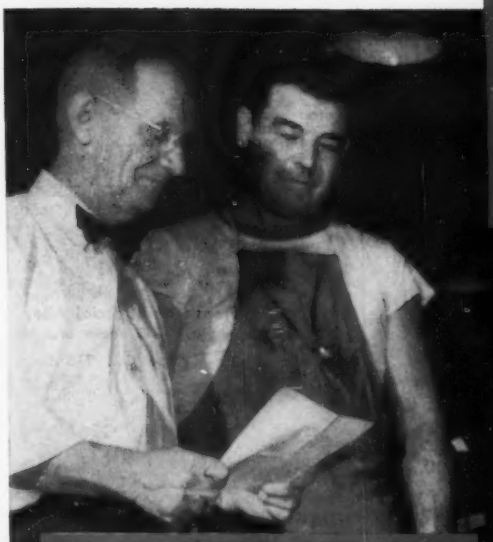
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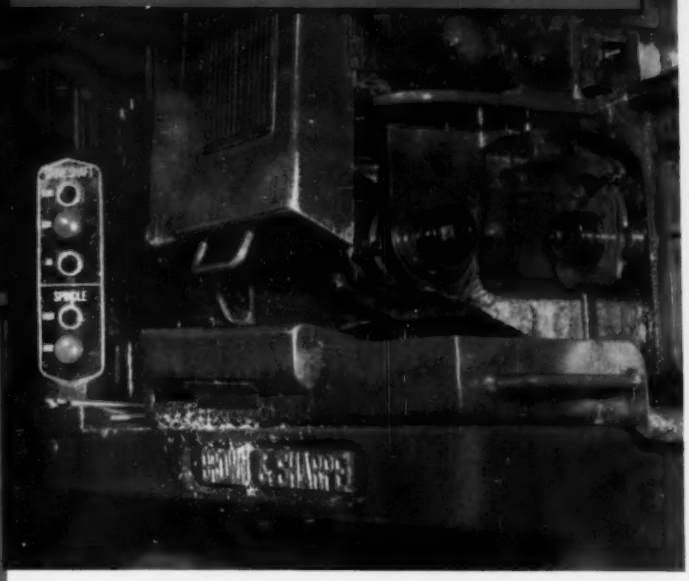
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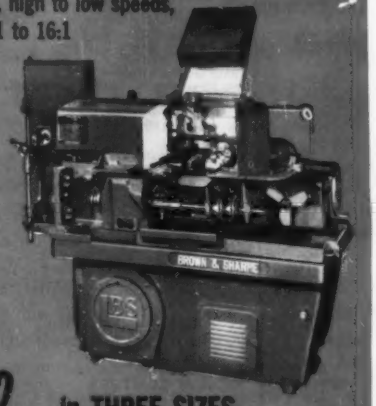






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takes stock to ½" diam.

Spindle speed range 7200 to 34 rpm
Turns any length to 1"
. . . with optional equipment, to 1½"
Ratios, high to low speeds,
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Take stock to	¾" dia.	1¼" dia.	1½" dia.
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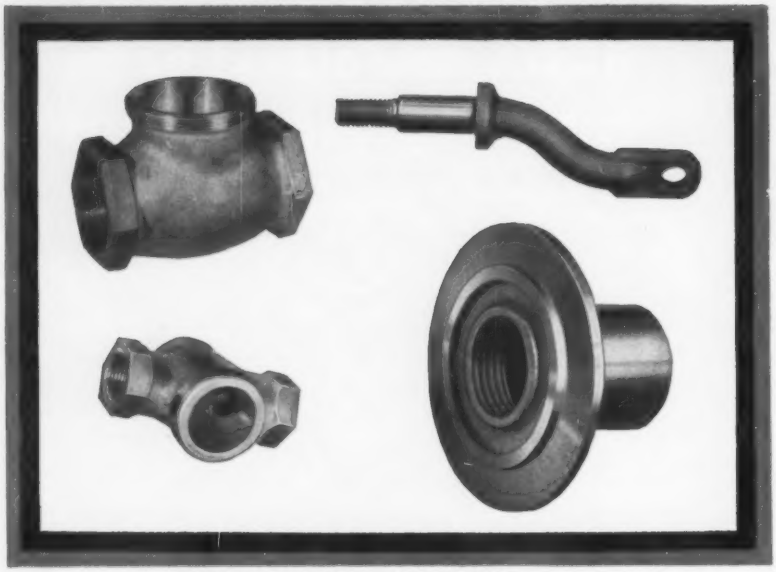
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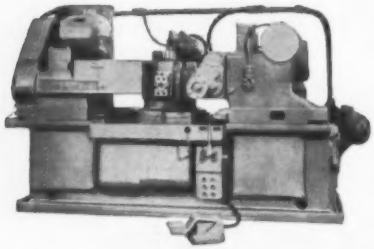
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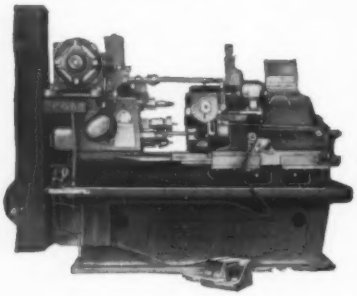


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Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
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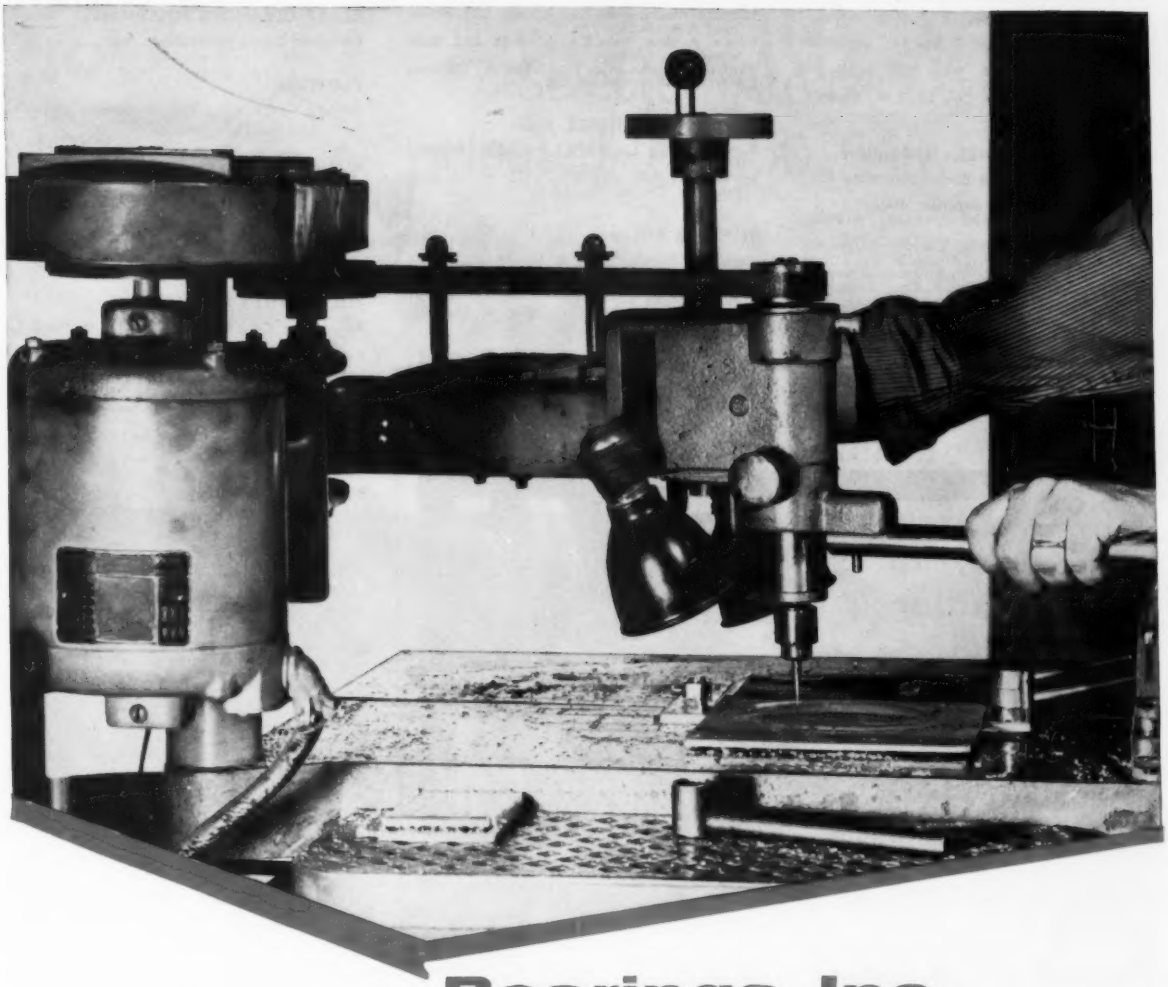
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Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
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DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wesson Co., 120 Woodward Heights Blvd., Detroit 20, Mich.

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Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
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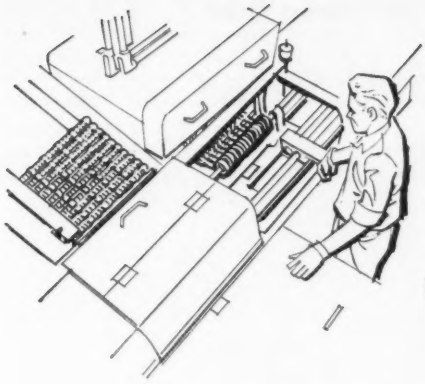
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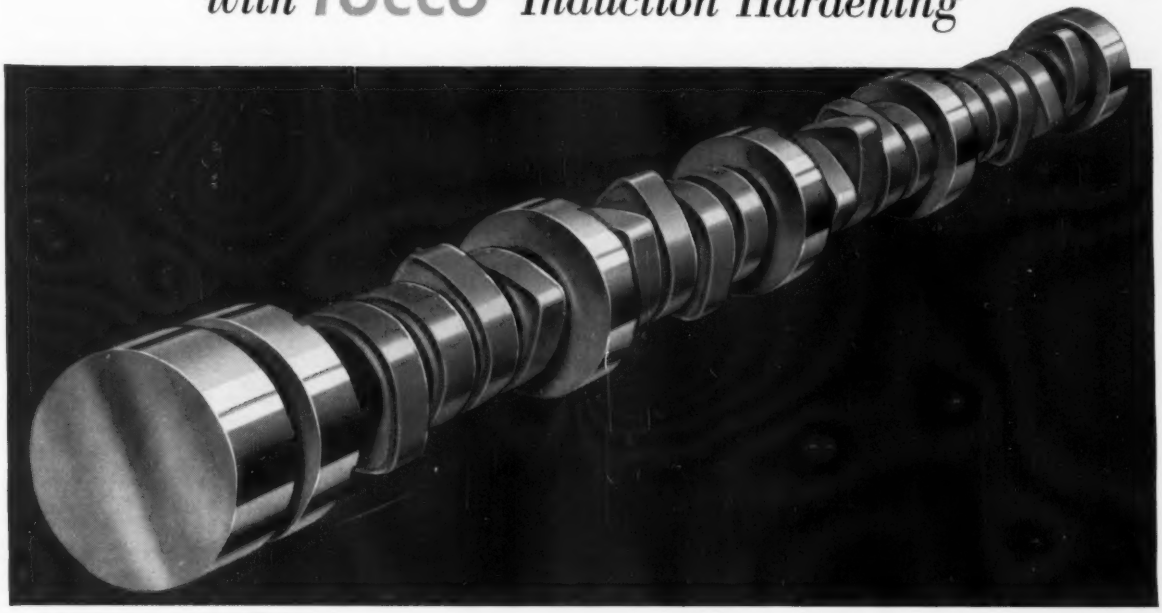
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Wales-Strippit Co., Akron, N. Y.

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Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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Vascoloy-Ramet Corp., Waukegan, Ill.
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Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

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Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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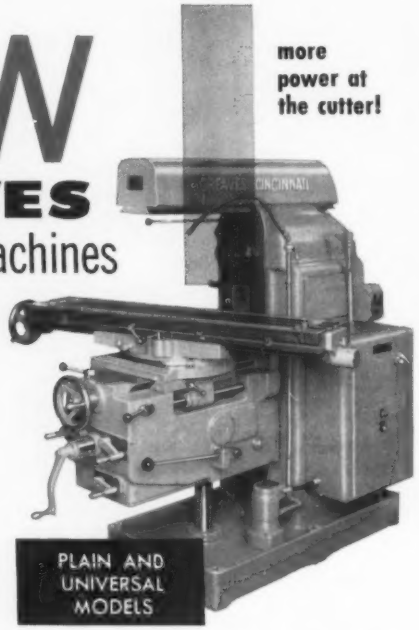
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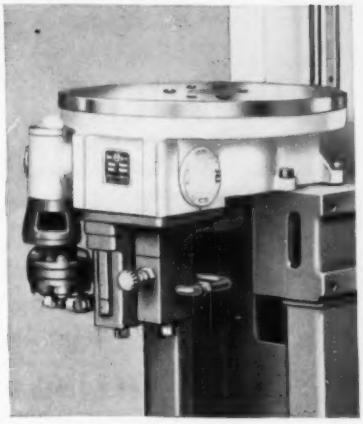
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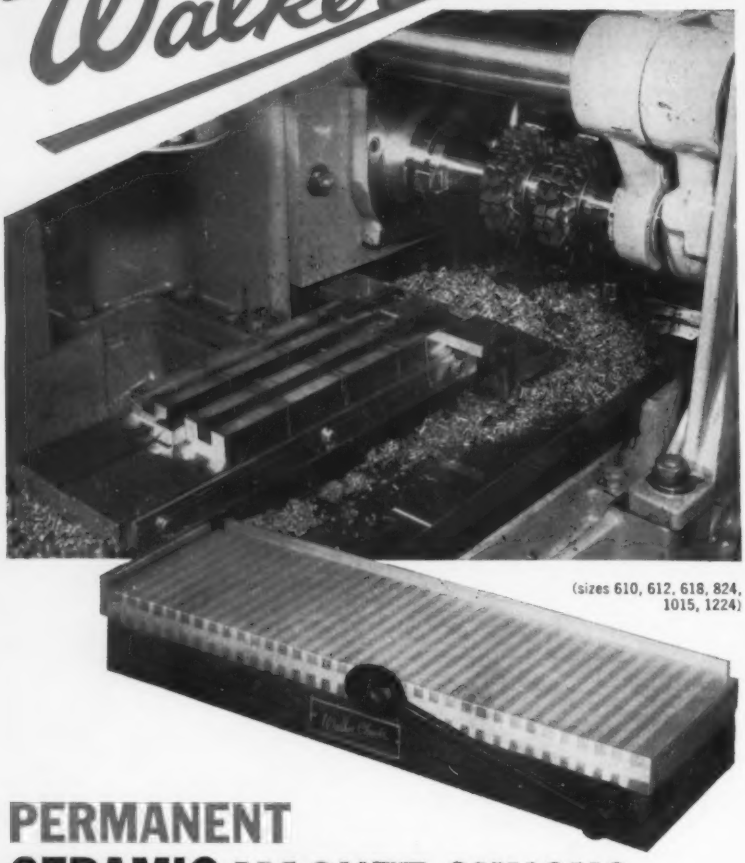
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Universal Engrg. Co., Frankenmuth, Mich.

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DoAll Co., Des Plaines, Ill.
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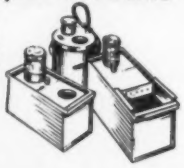


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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

CENTER-DRILLING MACHINES

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
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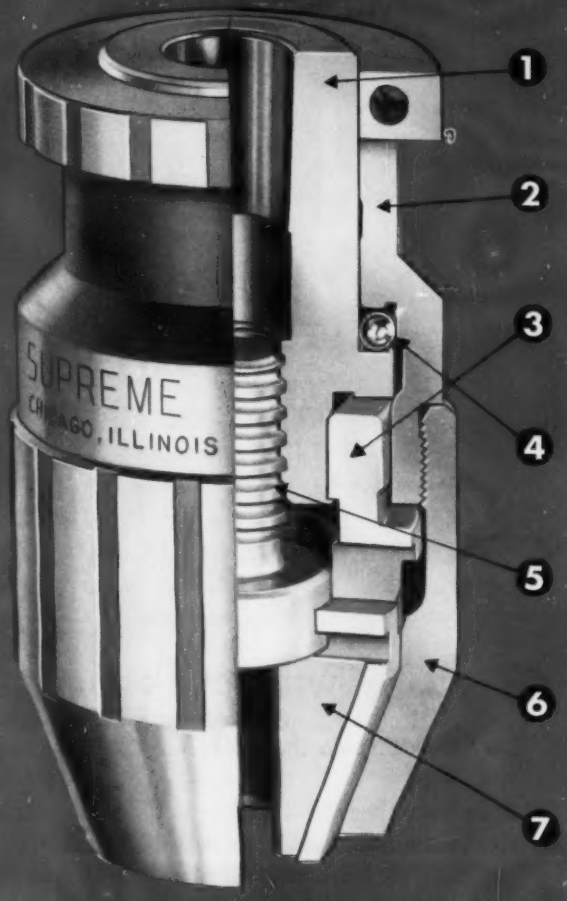
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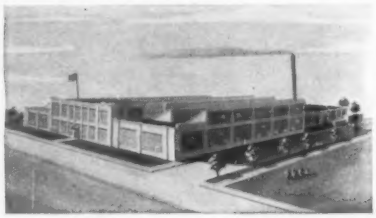
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Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Drill, Key Type
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Full Floating
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

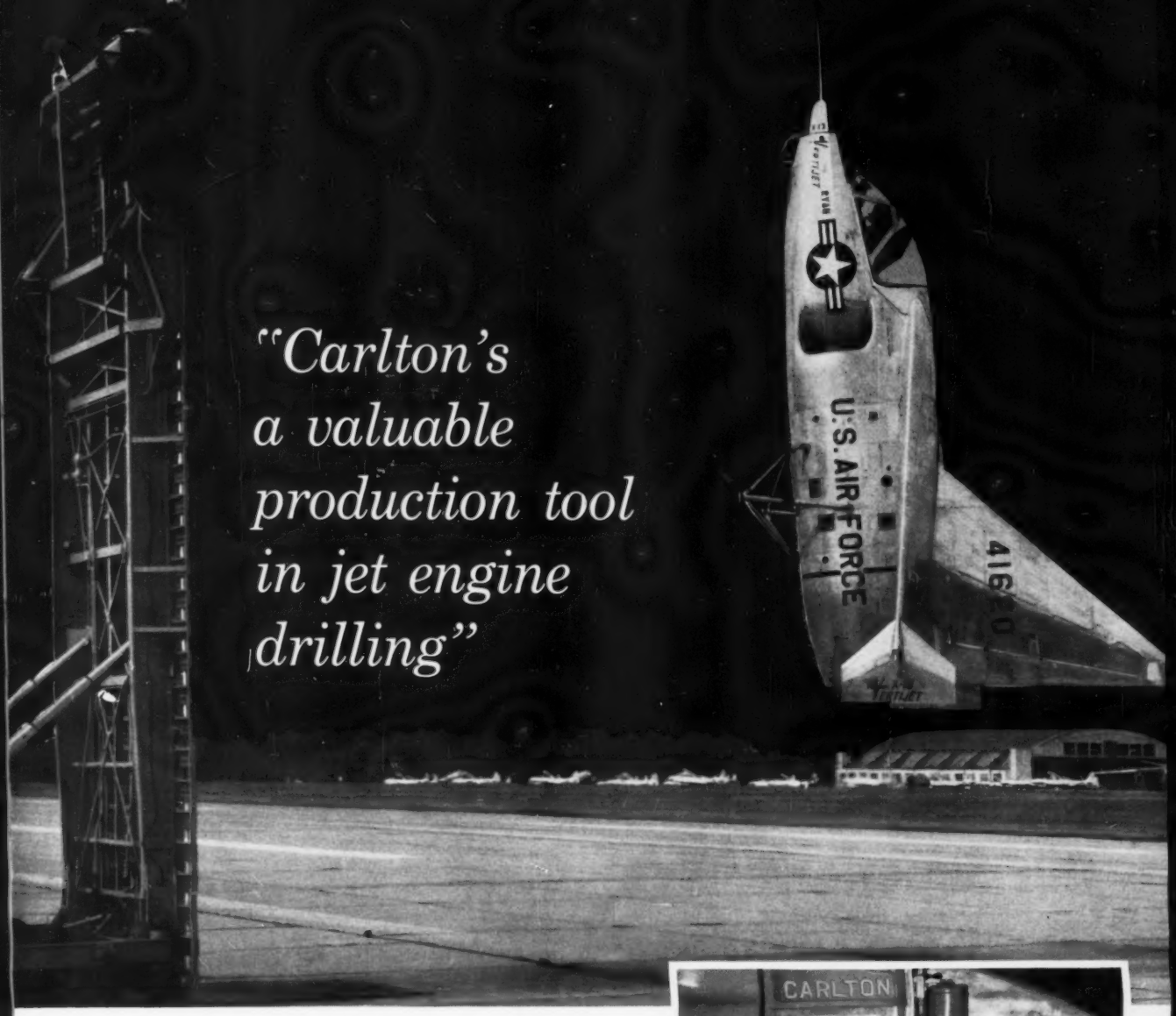
CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
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Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Oakite Products, Inc., 26 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Minster Mch. Co., Minster, Ohio.

COLD HEADING
Hassall, John, Inc., Westbury, L. I., N. Y.
National Machinery Co., Tiffin, Ohio

COLLETS—See Chucks, Collet

COLLOIDAL GRAPHITE
Acheson Colloids Co., 2150 Washington Ave., Port Huron, Mich.

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., 54 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
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National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

COUNTERS

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CUTTERS, Keyseating

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoAll Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati, Ohio.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type

Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Mocern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co. 1 New Bond St., Worcester 6, Mass.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.



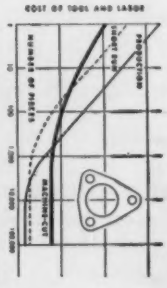
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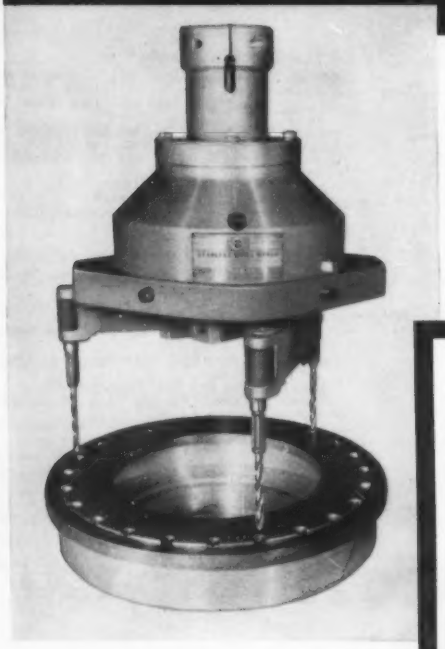
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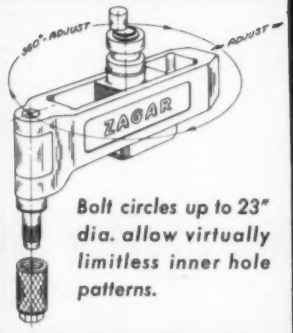
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DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14 Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Cincinnati Milling Products Div., Cincinnati Milling Mchc. Co., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

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Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material
CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

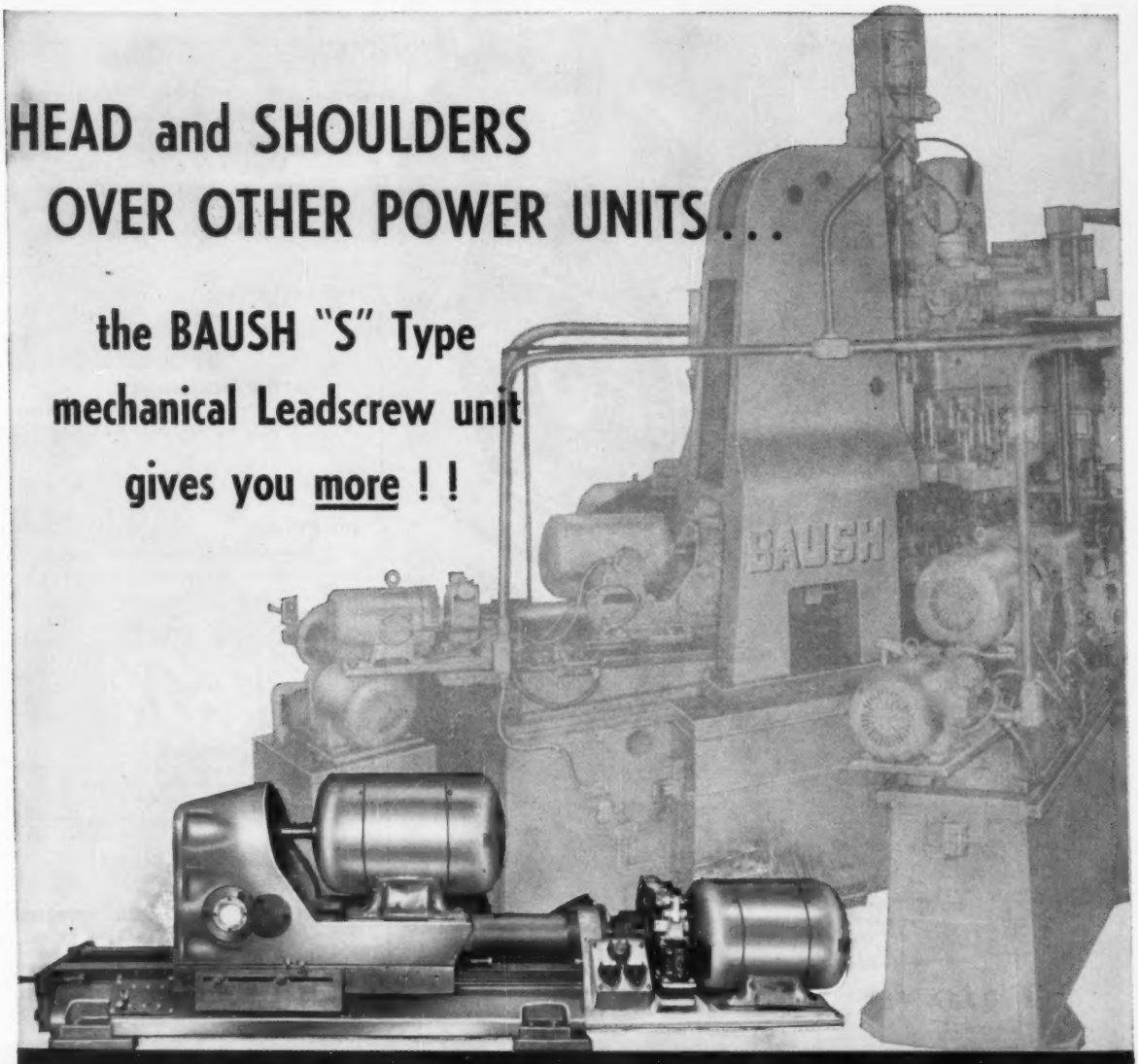
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

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DIE CASTINGS—See Casting, Die

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Hydraulic Press Mfg. Co., Mount Gilead, Ohio

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

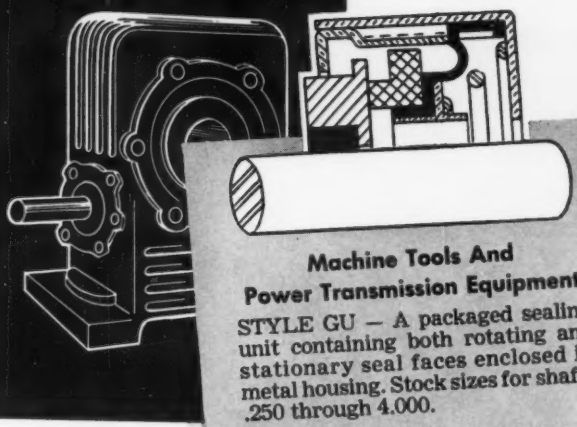
DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES
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Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

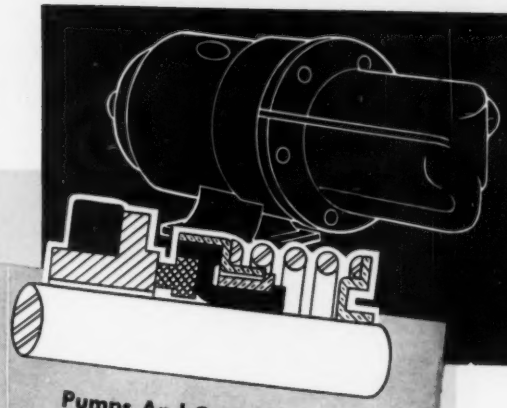
DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.
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Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St, Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
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Machine Tools And Power Transmission Equipment

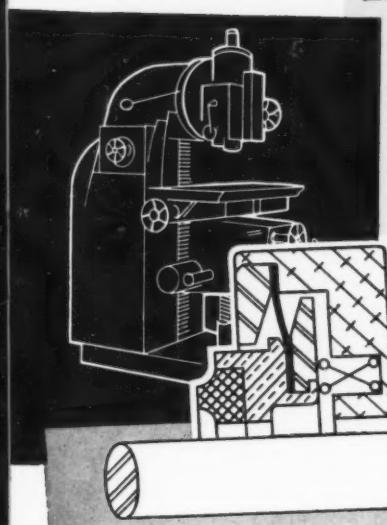
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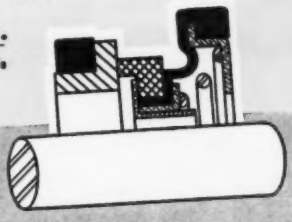
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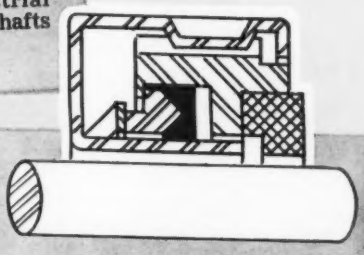
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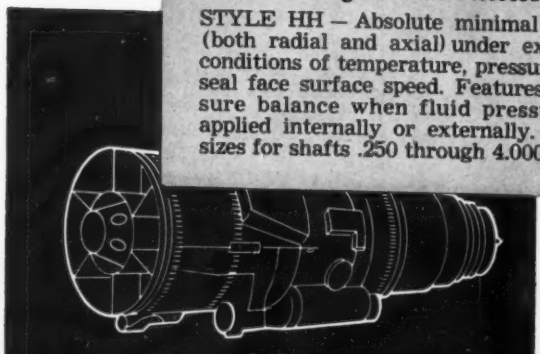
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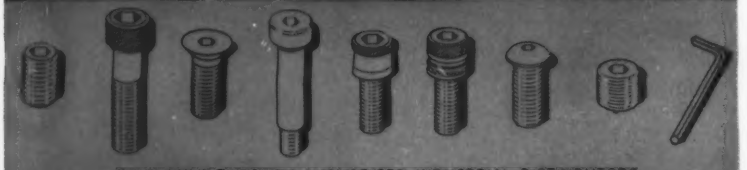
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Actual cross-section diagram shows how cold forming of Blue Devil Socket head insures unimpaired fiber continuity.







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National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
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Pratt & Whitney Co., Inc., West Hartford, Conn.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

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DIVIDING HEADS—See Indexing and Spacing Equipment

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

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Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

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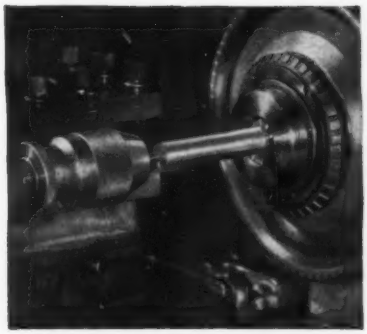
DRILL HEADS, Multiple Spindle
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Delta Power Tool Div., 400 N. Lexington Ave., Milwaukee 10 Wis
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
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(Continued on page 256)



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Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois

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DoAll Co., Des Plaines, Ill.
National Automatic Tool Co., Richmond, Ind.
National Twist Drill & Tool Co., Rochester, Mich.

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Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
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Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
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Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio

Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.

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Ex-Cell-O Corp., 1200 Oakmon Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

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Barnes, W. F. & John Co., Rockford, Ill.
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Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
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Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
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DRILLING MACHINES, Sensitive

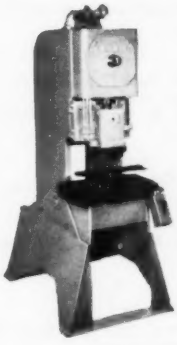
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
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(Continued on page 258)

It has the New Torc-Pac 22 Press Drive

WITH AIR FRICTION CLUTCH & BRAKE





The Clearing Torc-Pac 22 has the unique press drive shown in cutaway above. The complete operating mechanism from main motor to slide is combined into a compact package separate from the press frame. This offers flexibility and accessibility that will cut maintenance costs to the very minimum. The clutch in this remarkable press drive is a completely new wet disc design. You will find no other like it in the press industry. The friction discs are submerged in oil. Films of oil between the plates actually "pick up" or start the engagement. Result? The linings don't wear the way conventional linings would. You never have to adjust the clutch. You can operate for years without replacing linings.



More data on the Torc-Pac 22 with its unique clutch and brake and other features is yours for the asking. Write Clearing.

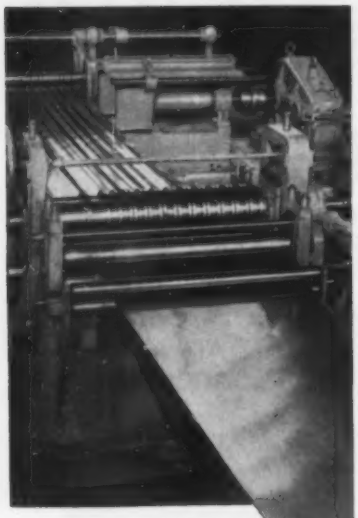
Also available in 32 & 45 ton capacities

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the way to efficient mass production

CLEARING MACHINE CORPORATION *division of* **U.S. INDUSTRIES, INC.**

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Greater Profit and Operational Flexibility with a

YODER SLITTER

Even if you use less than 100 tons of varied strip sizes per month, it will pay you to investigate the savings that are possible through the operation of a Yoder slitter. Savings per ton increase rapidly as coil size and width of strands decrease...so much, that under average operating conditions, a slitter will pay for itself in a few months.

From a small stock of standard mill-width coils, a Yoder slitting line enables you to meet unexpected demands, or to supply "special" width slit strands in a matter of a few hours. This flexible operation increases plant efficiency, resulting in savings of time and money through simplified production planning and greatly reduced strip inventories.

The Yoder line includes slitters of every size and capacity for coil or sheet stock. Send for the all-new, 1958 edition of the Yoder Slitter Book. It is a comprehensive text on the mechanics and economics of slitter operations with time studies, cost analyses, and other valuable data. Write to:

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5504 Walworth Avenue • Cleveland 2, Ohio

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National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Universal Radial
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
LeMaire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.

DRILLS, Center
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

DRILLS, Deep Hole, Gun
Ace Drill Corp., Adrian, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Oil Hole, Oil Tube
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DRILLS, Subland
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St. Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Ace Drill Corp., Adrian, Michigan
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES—See Disintegrators

ELECTRONIC CONTROL SYSTEMS
Electronic Control Systems, 2231 S. Barrington Ave., Los Angeles 64, Calif.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXPANDERS, Mechanical, Hydraulic
Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

YEARS OF PROFITABLE PRODUCTION

BUILT INTO

"BUFFALO"

NO. 18 DRILLING MACHINES

These drills are constructed to provide the longest possible useful life and the utmost accuracy in operation. Easy to set up and operate, the rugged, dependable No. 18 is designed to cut production costs in a wide variety of operations.

Quality Features of the "Buffalo" No. 18 Drill:

- **SPINDLE** — Multiple-splined alloy steel, ground, polished and carefully balanced. Rotates in two precision-type ball bearings, designed to take the thrust of heavy-duty operations. Design of spindle pulley bearings prevents torque being transmitted directly to spindle.
- **FRAME** — Large, heavy head frame insures accuracy throughout life of machine.
- **TABLES AND BASES** — Built to extra-heavy proportions, with large working surfaces.
- **RAISING SCREW** — Full ball bearing construction, actuated by machine-cut steel screw and gears. Three ball thrust bearings provide easy operation.
- **FOOT FEED** — Operated by a gear meshing the feed pinion. Foot treadle return by torsion spring, giving maximum return pressure at end of stroke.

For capacities up to 1" in cast iron, the "Buffalo" No. 18 Drill is your best buy. Available in floor and bench models — bench types up to 6 spindles.

Contact your "Buffalo" machine tool dealer for full information on the No. 18 Drill, or write us direct for Bulletin 3123-E.



Every "Buffalo" Machine Tool brings you the exclusive "Q" Factor—the built-in QUALITY which provides trouble-free satisfaction and long life.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.



BUFFALO FORGE COMPANY

440 BROADWAY • BUFFALO, N. Y.

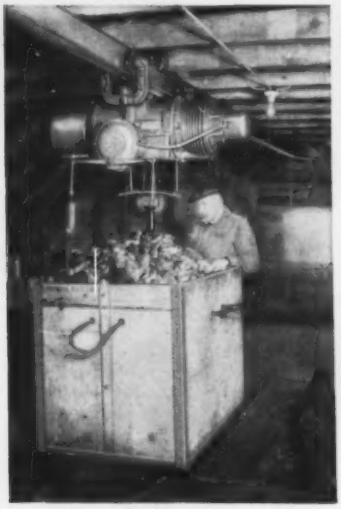
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

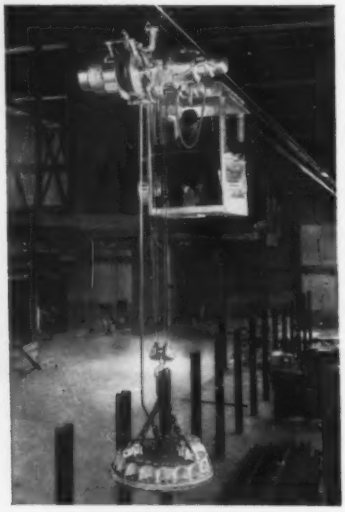
SHEPARD NILES
HOISTS

CUT HANDLING COSTS

in YOUR plant with the right hoist



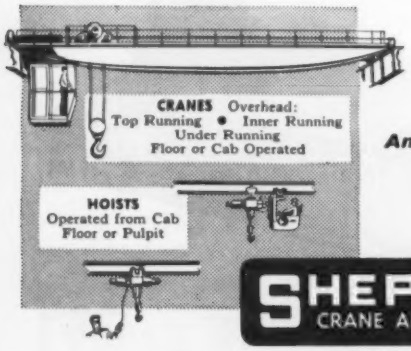
FLOOR-OPERATED HOIST
Operator primarily occupied with other duties, uses hoist for fast, efficient short hauls.



CAB-OPERATED HOIST
Cab operator moves loads at high speeds, can quickly spot material for handling.

WHICH Shepard Niles hoist fits your plant's needs . . . a floor-operated hoist where the operator is freed for other duties or a cab-operated hoist where the operator is engaged full time moving loads through the air? Shepard Niles manufactures both types in capacities from 1 to 20 tons.

Send for the descriptive bulletins on both Cab and Floor Operated Hoists . . . or ask that a Shepard Niles representative call — there's NO OBLIGATION.



Building
America's Most Complete Line
of Cranes and Hoists
Since 1903

SHEPARD NILES
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1596 Schuyler Ave., Montour Falls, N.Y.

Hassall, John Inc., Westbury, L. I., N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

FEEDERS, Automatic
Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
V & O Press Co., Hudson, New York

FILES, Band
DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoAll Co., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoAll Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

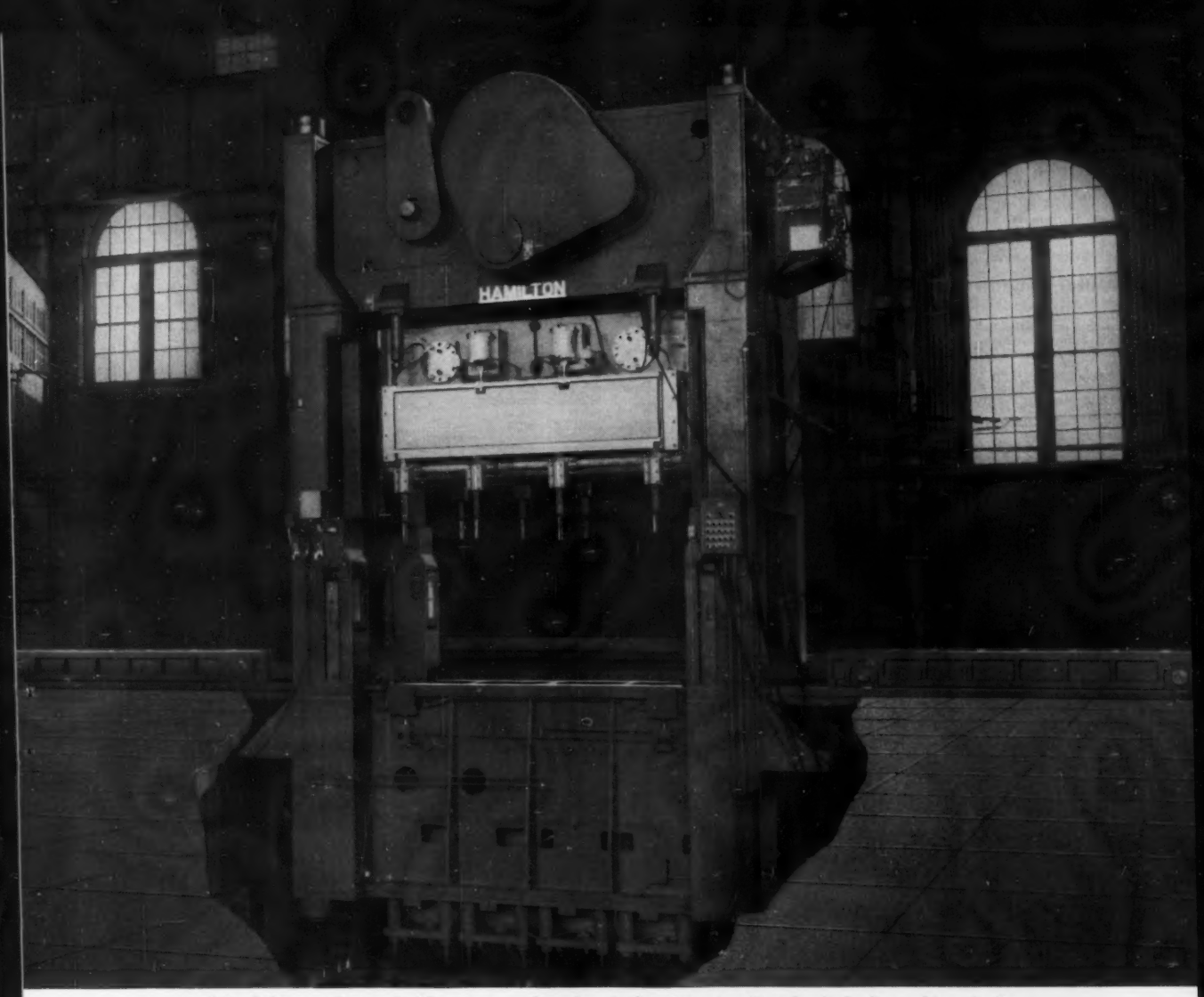
FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

FORMING MACHINES, Cold-Rolling
Ferracute Machine Co., Bridgeton, N. J.
(Continued on page 262)



Sliding bolsters on this new Hamilton press are shown here in the outermost positions for die loading and/or unloading.

HAMILTON ANNOUNCES A RADICAL NEW PRESS DESIGN

This new Hamilton straight-side press—using sliding bolsters and preset dies—is a radical advance in design for performing such operations as blanking, drawing and forming. Its principal feature is the rapidity with which dies can be changed—and the resulting increase in production. As little as 15 minutes need elapse between the end of one production run and the start of another.

This new Hamilton press is ideal for short runs, assures minimum downtime for changing dies, means higher production than two conventional presses in many instances. At the same time, it eliminates both the cost of a second press and of additional operators. Also the sliding bolster feature does away with the time-consuming method of jockeying dies with both cranes and fork trucks—an overhead crane can be used exclusively.

Write today to Dept. 3-K for full details on the high production, cost-saving Hamilton press.

Hamilton Division Hamilton, Ohio

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Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools & general machinery

BALDWIN BLH LIMA-HAMILTON

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima- Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

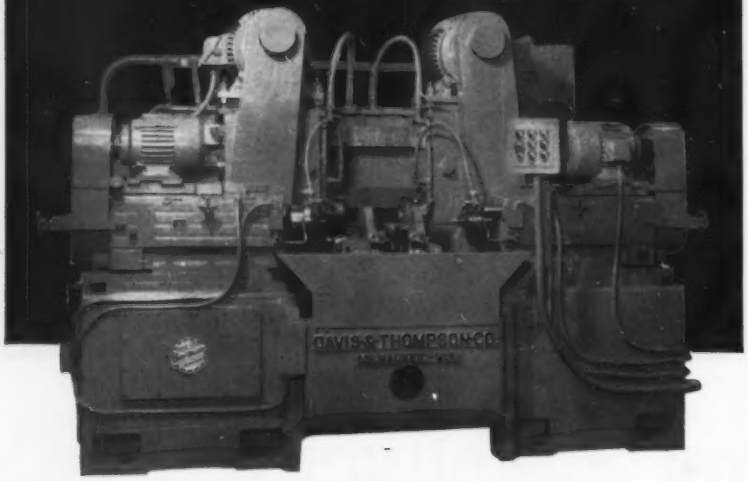
FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

Basic Standard Machines *PLUS* D&T Engineering Will Give You More Profitable Production . . .



HERE'S WHY: Although this machine has been adapted to milling and centering of small shafts, its basic design lends itself to other operations through the addition of various types of heads as well as multiple spindle drill heads.

Feeds and speeds are variable. The hydraulically operated machine table is equipped with an air-operated fixture which is electrically controlled for either automatic or mechanical cycling.

If you need production with a minimum capital outlay, it will pay you to call in a D & T production engineer. There is no obligation for this service.



ADDITIONAL INFORMATION

For more examples of outstanding production machine tools, write for Bulletin 1002.

Roto-Matic Davis and Thompson Co.
4460 N. 124th ST. MILWAUKEE 10, WISCONSIN

GAGES, Air Comparator

Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection

Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel and Spiral

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn. Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS

Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Nonmetallic

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

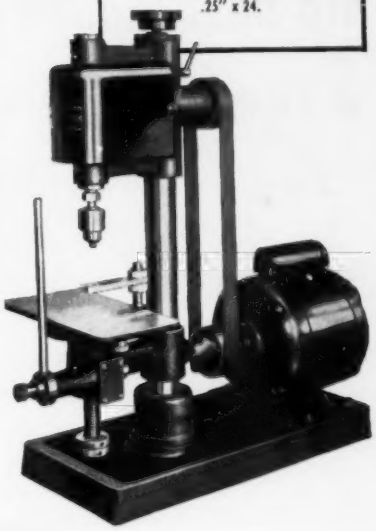
GEARS, Cut

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefedorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio

(Continued on page 264)

Now *Precision* TAPPING OF THIN AND BRITTLE MATERIALS

Hamilton Super Sensitive, Small-Hole, Precision Tapping Machine.
Capacity — .034" x 120 to .25" x 24.



Recent design change provides a simple homing device as a standard component of the

HAMILTON SUPER SENSITIVE, SMALL-HOLE PRECISION TAPPING MACHINE

and makes routine of such problem work as the tapping of precision holes in thin metal sheets or in brittle plastics. Even improves performance in the tapping of blind holes!

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will want full information about this important development!

WE WILL FURNISH IT

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2463



"CLAUSING 12¾" lathes are the best values on the market!"

. . . says BILL ROGIE

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"Without question, Clausing 12¾" Lathes give you more for the money than any lathe of comparable size or price. We especially like their heavy construction which enables us to take deeper cuts, and hold tolerances better on repetitive operations." This statement by Bill Rogie, Flynn Manufacturing Co., is typical of the reports we receive from Clausing owners everywhere. Here are a few of the reasons why:

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Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

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Mummert-Dixon Co., Hanover, Pa.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrumsnt Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Oliver Instrument Co., 1410 E. Maumee, Adrian, Mich. (also drill point thinner)
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Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

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Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

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Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Precise Products Corp., 3751 Blue River Rd., Racine, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

. . . Fluid Power news

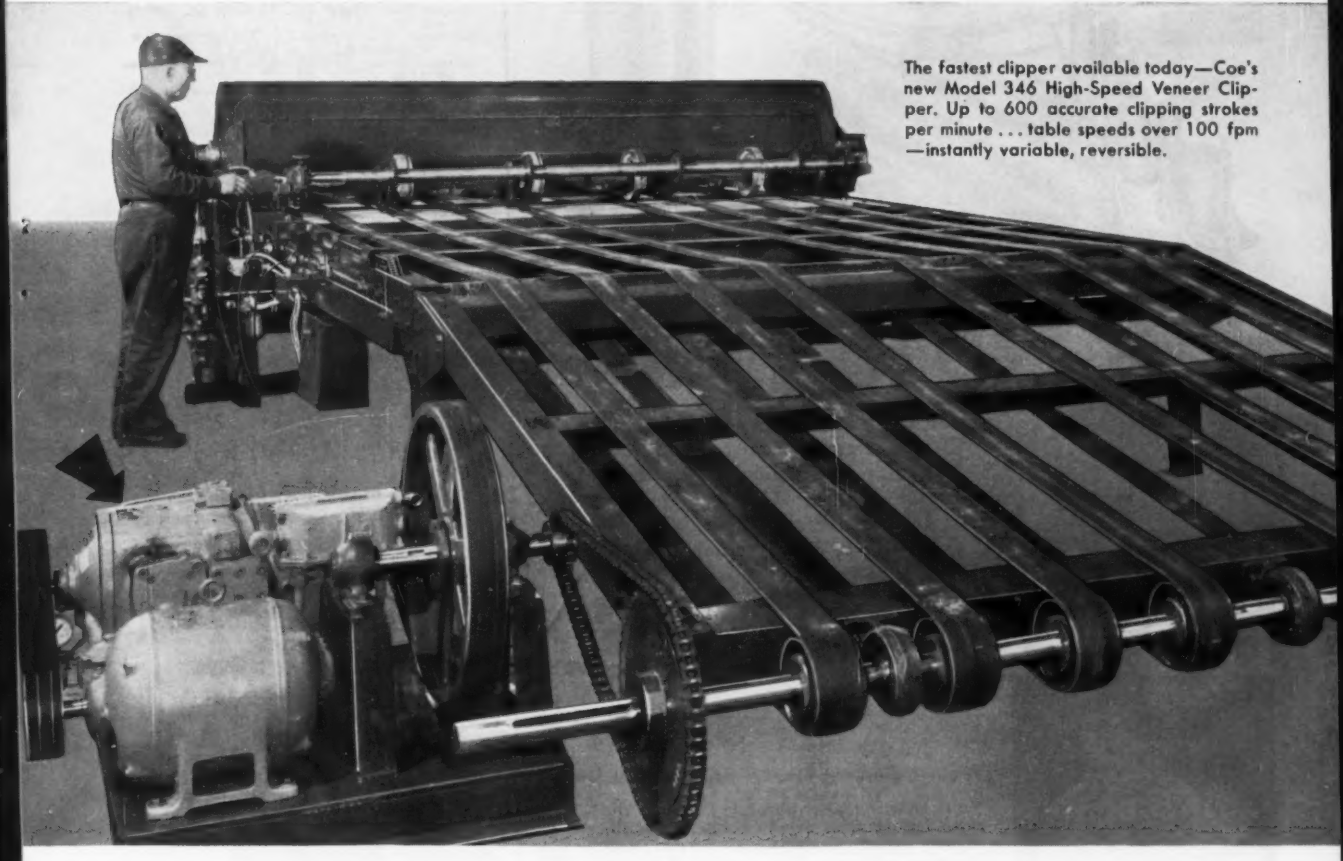
REPORT No. 11,501 HIGH-SPEED FEED TABLE DRIVE AND CONTROL

From Oilgear Application-Engineering Files

HOW OILGEAR "ANY-SPEED" DRIVES BOOST VENEER CLIPPING SPEEDS—ACCURACY

CUSTOMER: *Coe Machinery Company, Painesville, Ohio*

DATA: For high-speed, accurate sizing of single sheets of veneer in motion, table feed drives for new veneer clippers must be instantly, infinitely variable, and instantly reversible to clear slips and jams at the knife if ragged or defective veneer is encountered. Complete control should be through a remote, single lever. Drive must be rugged, compact, trouble-free . . . provide smooth, stepless, shock-free, uniform acceleration and deceleration from zero to maximum in either direction . . . easy to install and maintain.



The fastest clipper available today—Coe's new Model 346 High-Speed Veneer Clipper. Up to 600 accurate clipping strokes per minute . . . table speeds over 100 fpm —instantly variable, reversible.

SOLUTION: Shown above as standard equipment on Coe's new Model 346 high-speed veneer clippers are Oilgear heavy-duty DHC-88, two-way, *Any-Speed* Transmissions. Coe reports, "Variable table speeds are instantaneously afforded in forward and reverse. These drives are arranged to give belt speeds from approximately 70 to 175 fpm by movement of a single lever. The quick stop and reverse of this drive is very desirable if ragged or defective veneer slips and jams at the knife. This drive is equally desirable when the table drive is used to unload veneer storage decks between the clipper and the lathe." Oilgear *Any-Speed* Drives bring out the best in machines due to the many other "plus" features such as: cushioned power; automatic overload protection; automatic electric power conservation; totally sealed—safe in hazardous atmospheres; constant torque; automatically self-lubricated to insure long, trouble-free life.

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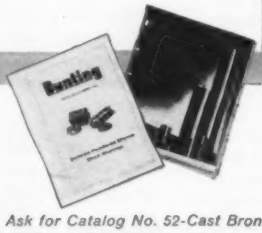
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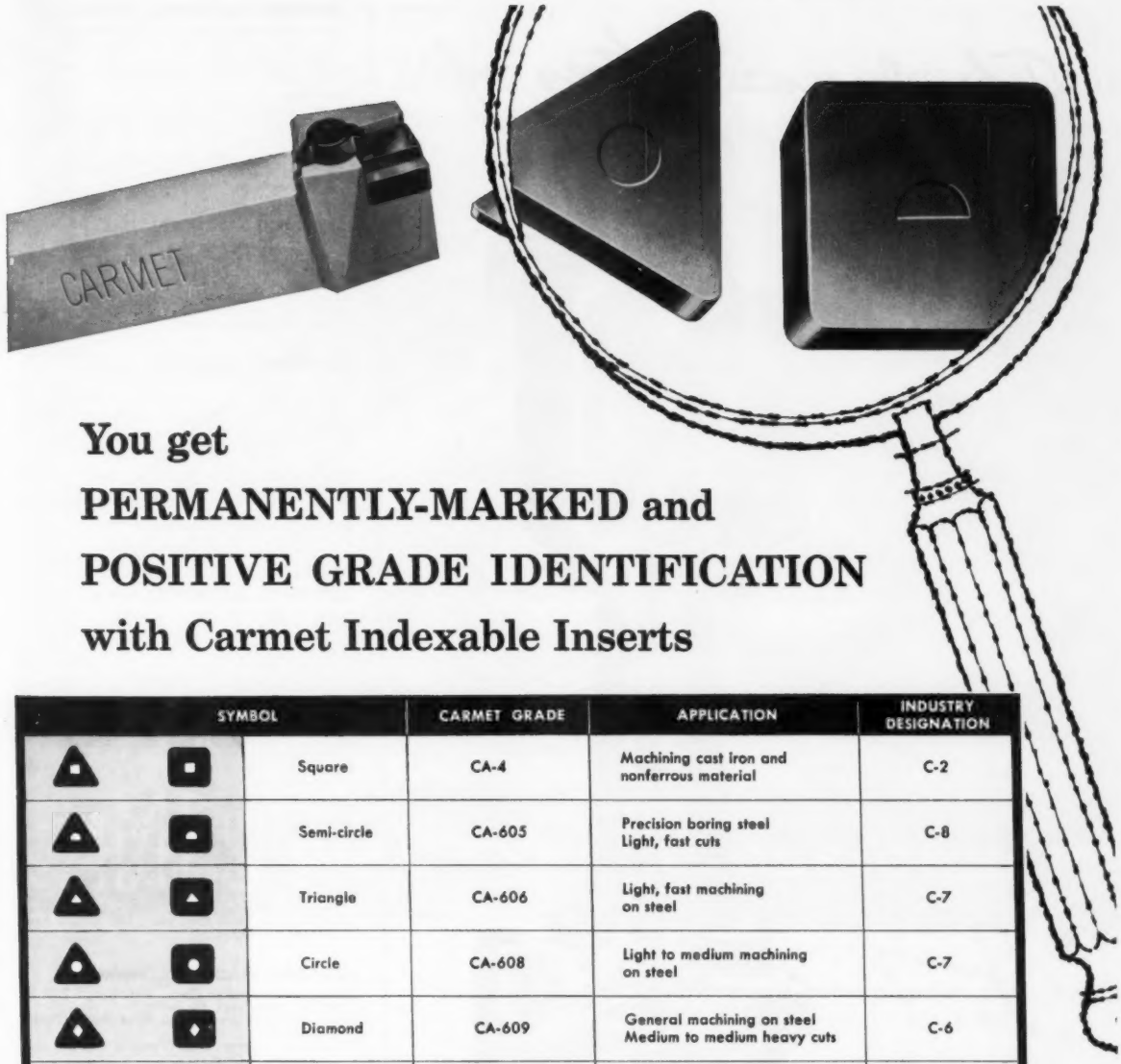
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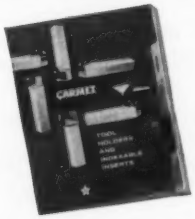
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Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

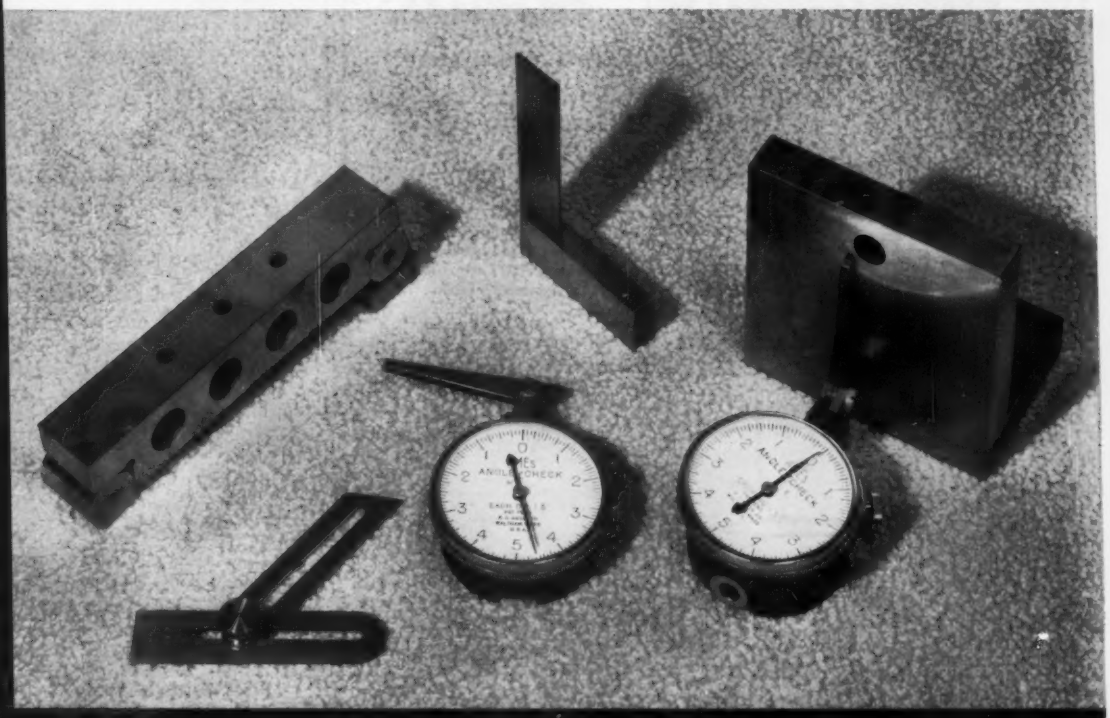
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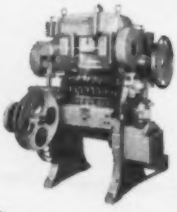
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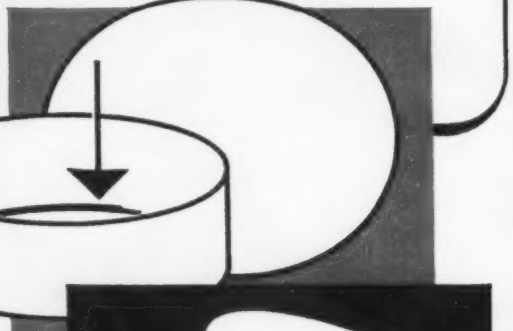
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Norton Co., 1 New Bond St., Worcester 6, Mass.
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Sheffield Corp., Box 893, Dayton 1, Ohio

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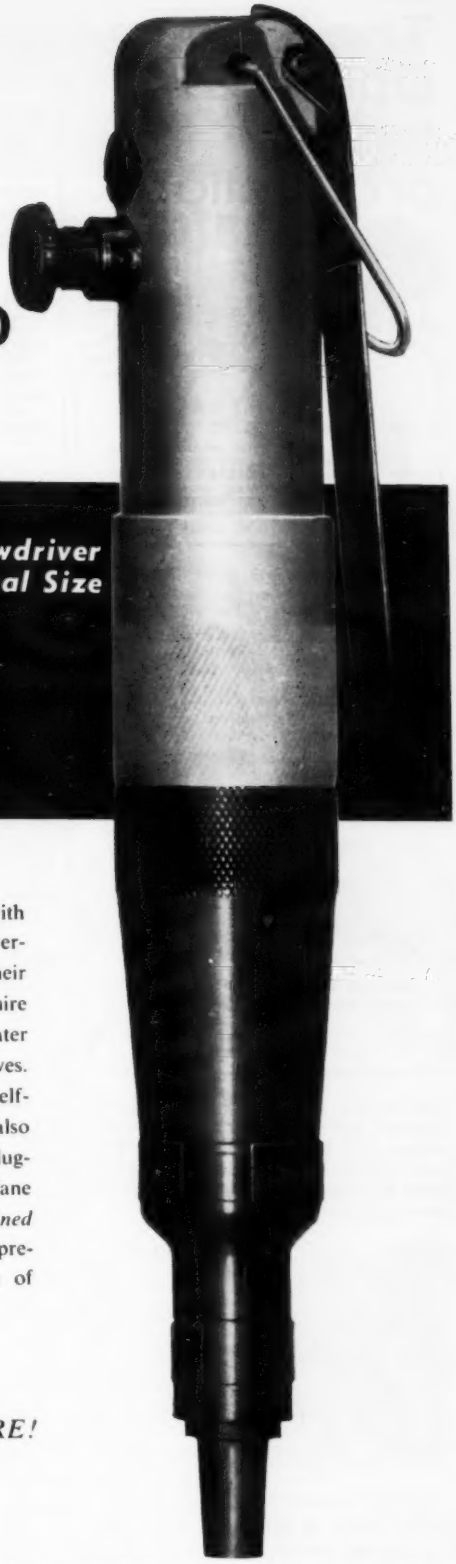
(*Continued on page 272*)

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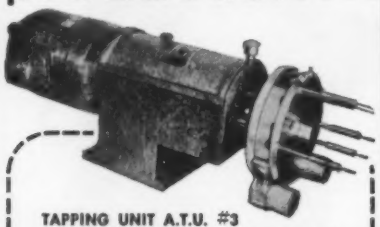
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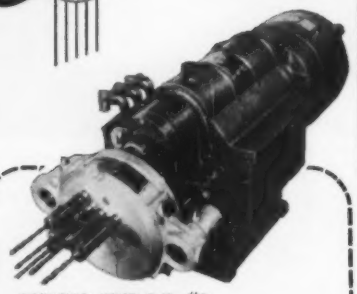
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Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
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Starrett, The L. S. Co., Athol, Mass.

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

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DeVlieg Machine Co., Fair St., Royal Oak, Mich.
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Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle
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Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench
Atlas Press Co., Kalamazoo, Mich.
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Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

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Sidney Machine Tool Co., Sidney, Ohio

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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Leblond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Enginering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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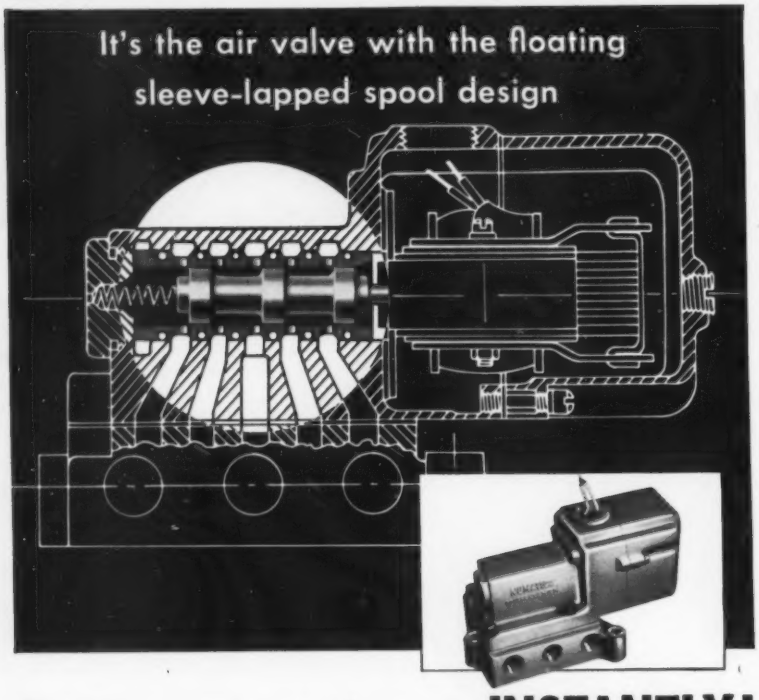
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
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Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

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Lodge & Shipley Co., The, Cincinnati 25, Ohio
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National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
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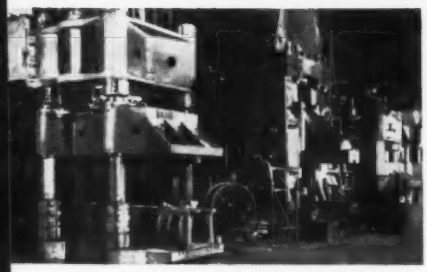
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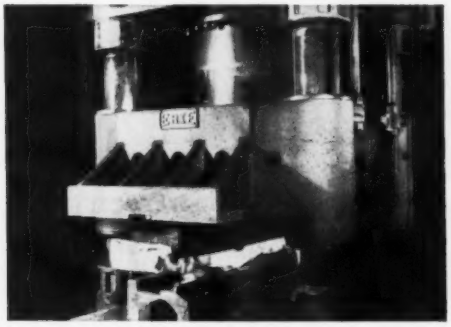
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Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
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G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
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Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo. Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
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Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
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Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.



PRESSES, Notching
Alva Allen Industries, Clinton, Missouri
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing
Alva Allen Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., Gulph Rd., King of Prussia, Penna.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Rubber-Forming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming
Alva Allen Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PROTECTORS, Thread & Tube
Maybrun, A. E. Co., 920 Ripley St., Santa Rosa, Calif.

PULLEYS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Little Giant Pump Co., 5101 Classen Blvd., Oklahoma City 18, Oklahoma
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic
American Engineering Co., Wheatsheaf Lane & Sepviva St., Philadelphia 37, Penna.
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Wilson, K. R., Inc., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, etc.
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

ROTARY TABLES, Optical
Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES
See Machinists' Small Tools

RUST INHIBITORS
Kasenit Co., Mahwah, N. J.
Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAW BLADE SHARPENERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

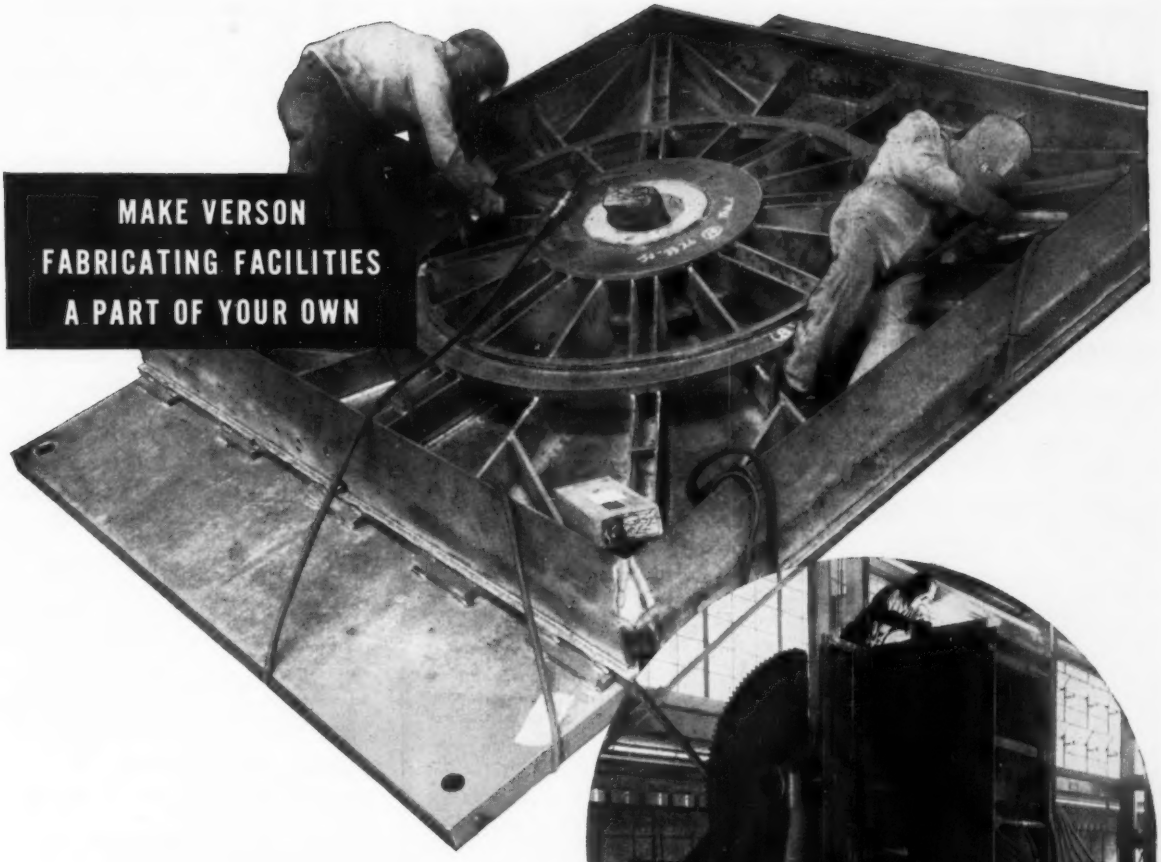
SAWING MACHINES, Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Cutron Mfg. Co., Lubbock, Texas
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., Kenosha, Wis.

SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ty-Sa-Man Machine Co., Inc., Knoxville, Tenn.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

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Why MICROHONING AT EVINRUDE trims costs . . . booms productivity . . . eliminates operations...improves quality

Evinrude Motors, Division of Outboard Marine Corporation, has replaced with Microhoning their former method of processing conn bores. Here's why:

MICROHONING INCREASES PRODUCTIVE CAPACITY 23 TIMES

Before Microhoning equipment was installed, Evinrude used diamond boring on wristpin and crankpin bores. Now! A per-man productivity comparison of the two processes shows: diamond boring, 300 rods in 40 hours; *Microhoning, 7,000 rods in 40 hours.*



Shown to the left is one of two lines of Microhoners. Each machine has: Microdial automatic stone-feed and stone-wear compensation; automatic stone-wear indicator; and Microsize Gage Ring automatic sizing control.

REDUCES OPERATIONS

Greatest cost-cutting contribution made by Microhoning is *elimination of three former operations:*

1. Re-milling locating faces of wristpin bores.
2. Straightening of rods after boring.
3. Milling oil hole grooves in wristpin bores.

ELIMINATES BRONZE INSERTS

The functional surface characteristics of Microhoned rod bores preclude the need for bronze bushings or shoes. Based on current production schedules, *the cost of millions of bronze inserts will be saved this year.*

ASSURES FEWER REJECTS

From a Microhoning run of 62,000, receiving 100% inspection on an air gage, only 200 rods required reprocessing. *This is a rejection rate of only 3/10 of 1%.*

IMPROVES PRODUCT QUALITY

Microhoning is a low-velocity abrading process that leaves bore surfaces free of torn, smeared or burned metal. Benefit: *Rods that have precise, longer wearing bores.*

To learn more of why Microhoning provides efficient stock removal, closer tolerances and functional surfaces, write to:

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Air Tools, P. O. Box 2119, Houston, Texas
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

SCREW MACHINES, Hand—See Lathes, Turrett, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain- Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS—Oil or Grease
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Lufkin Rule Co., Saginaw, Mich.
Northwestern Tools, Inc., 117 Hollier Ave., Dayton 3, Ohio
Starrett, The L. S., Co., Athol, Mass.

SHAPERS, Crank and Hydraulic
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rochford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Rotary
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Famco Machine Co., Kenosha, Wis.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

How MICROHONING AT EVINRUDE trims costs . . . booms productivity . . . eliminates operations . . . improves quality

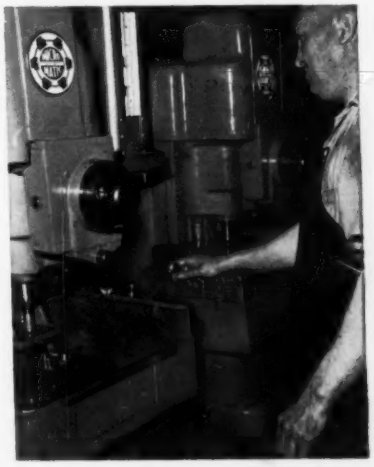
By installing Microhoning equipment to process wristpin and crankpin bores in conn rods, Evinrude Motors, Division of Outboard Marine Corporation, realized considerable savings. The following comparison with previously used diamond boring shows how Microhoning cut time, materials and costs:

MICROHONING BOOSTS PRODUCTIVE CAPACITY 23 TIMES

Diamond Boring Production Per Man: 300 rods in 40 hours.

Microhoning Production Per Man: 7,000 rods in 40 hours.

Several rod sizes are Microhoned on the same equipment — bore diameters range from .874" to 1.500", bore lengths from .815" to 1.011". Microhoning removes .005" stock from wristpin bores in about 24 seconds (floor-to-floor) and generates a controlled finish of 25 to 30 microinches as specified. On crankpin bores, Microhoning removes .0005" stock to generate specified finish of 3-5 microinches in 17 seconds (F-T-F). Tolerances on both bores are held to .0001" for roundness and straightness, and .0004" on diameter.



Close-up of double unit Microhoner shows operator checking a wristpin bore on air gage. Microdial, which automatically compensates for abrasive wear, is shown in center of photo.

ELIMINATES THREE OPERATIONS

1. Former re-milling of locating face on wristpin bore is eliminated — *Microhoning's float principle maintains original bore location.*

2. Straightening after rough boring is no longer required — *Microhoning tool follows neutral axis of bore.*

3. Milling oil hole grooves in wristpin bores is eliminated — *Microhoning generates a cross-hatch pattern that provides built-in oil reservoirs.*

SAVES COST OF MILLIONS OF BRONZE INSERTS PER YEAR

Microhoning's low-velocity abrading, with efficient cutting over a wide area, produces surfaces free of torn, smeared or burned metal.

Result: Precise bores having surfaces that resist galling and flaking.

Benefit: User obtains longer wearing rod bores and a functional supplanting of bronze inserts.

For further information on Microhoning process or to receive movie "Progress in Precision", write to:

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.



SPEED REDUCERS
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
DoAll Co., Des Plaines, Ill.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPINDLES, Machine
Bearings, Inc. 3634 Euclid Ave., Cleveland 15, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. St., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio

SPRAYING EQUIPMENT, Metal
Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS
Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES
DoAll Co., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRIP AND SHEET, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.

Don Oberg tells why the Moore Jig Grinder is an absolute must in any good die shop



by **DON E. OBERG**
General Manager
Oberg Manufacturing Co., Inc.
Tarentum, Pa.
Largest Manufacturer of
Carbide Dies

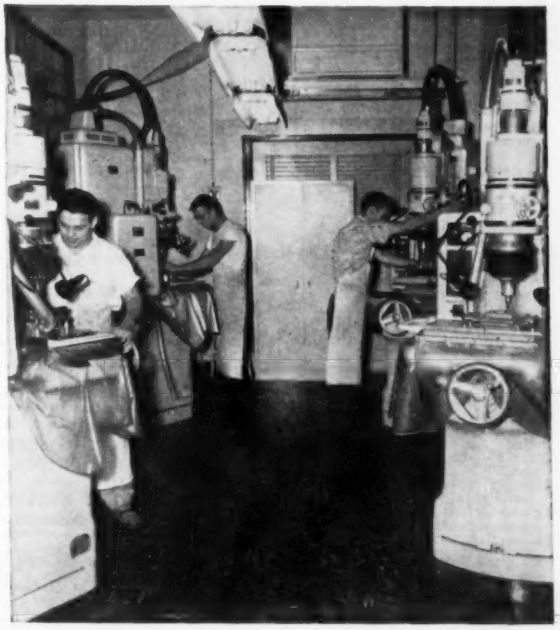
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Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
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Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

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Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
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Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
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Threadwell Tap & Die Co., Greenfield, Mass.
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National Acme Co., 170 E. 131st St., Cleveland, Ohio
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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
National Machinery Co., Tiffin, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
V & O Press Co., Hudson, New York

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Lathem Time Recorder Co., Atlanta 8, Georgia

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Cross Co., 3250 Bellevue, Detroit 7, Mich.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Cast Non-Ferrous Alloy
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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Cleveland Twist Drill Co., 5214 W. Armstrong, Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic
Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

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G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit Co., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

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Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
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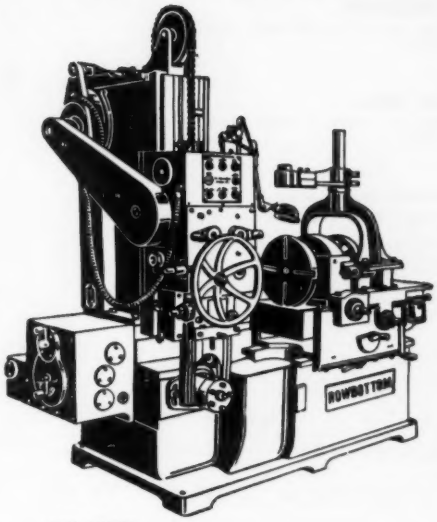
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Mueller Brass Co., Port Huron 34, Mich.
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Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
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Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
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Vickers, Inc., Detroit 32, Mich.

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Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

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Barnes, John S. Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
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Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

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Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave. Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hts. Blvd., Detroit 20, Mich.

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Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
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WELDING POSITIONERS
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Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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Scott Paper Co., Chester, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.

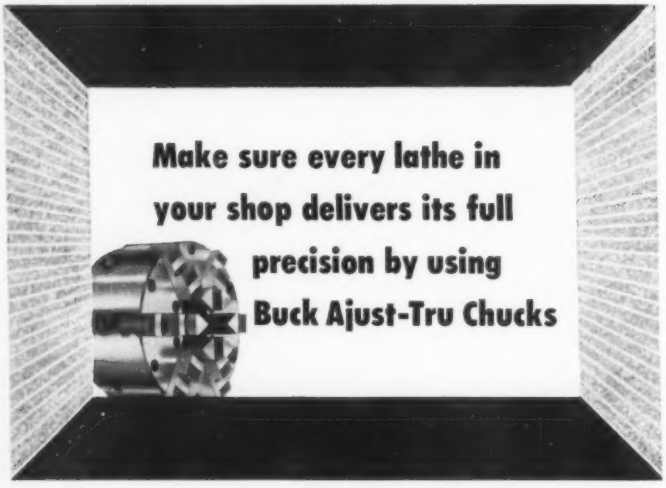
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WOODWORKING MACHINES
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave. Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

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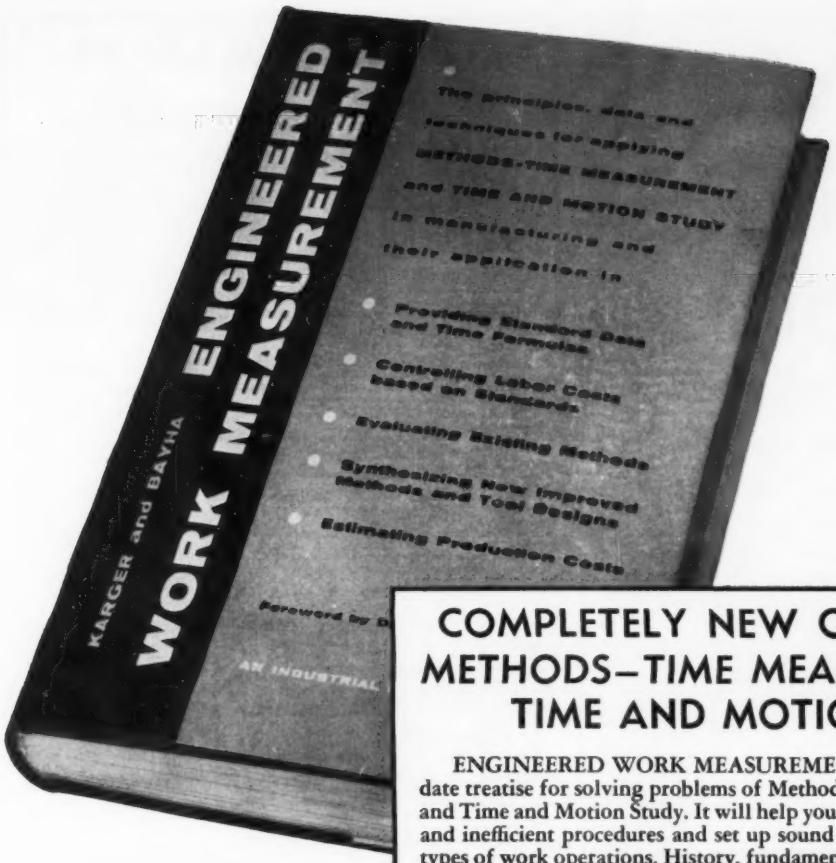
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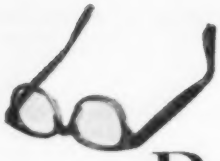
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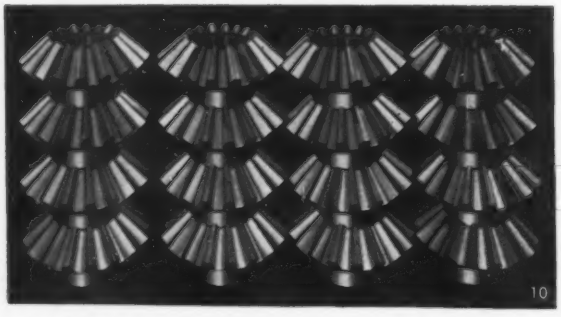
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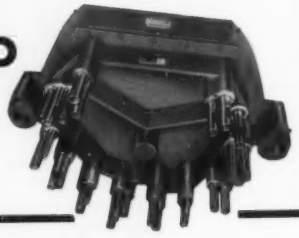
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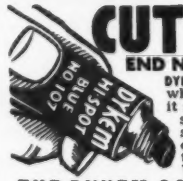


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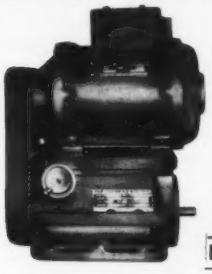
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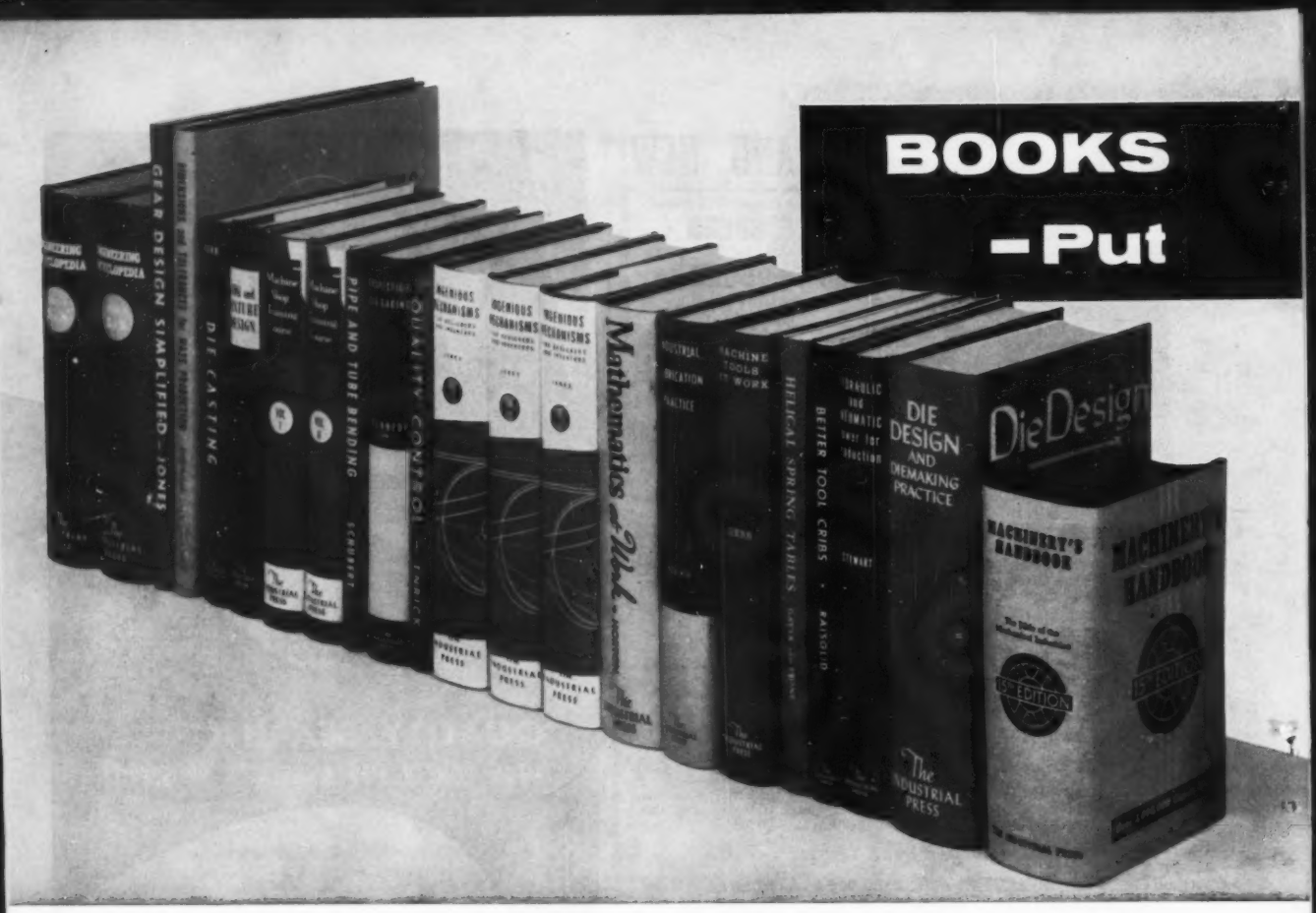
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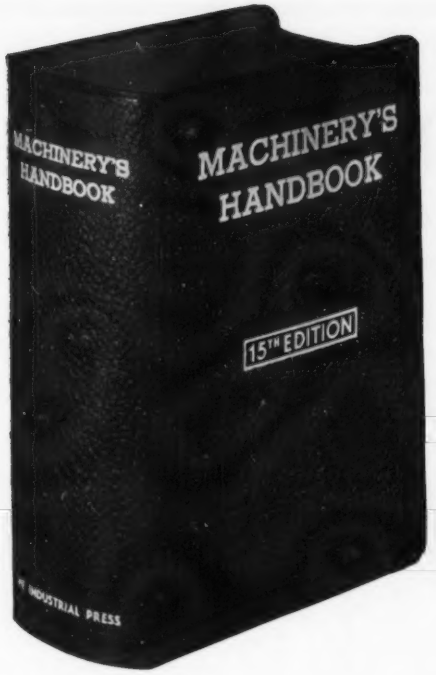
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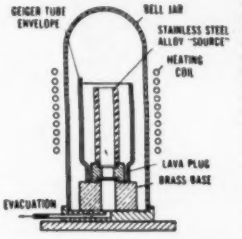


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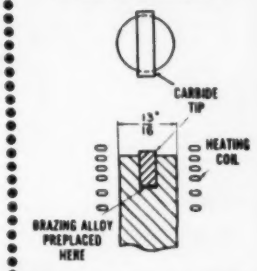
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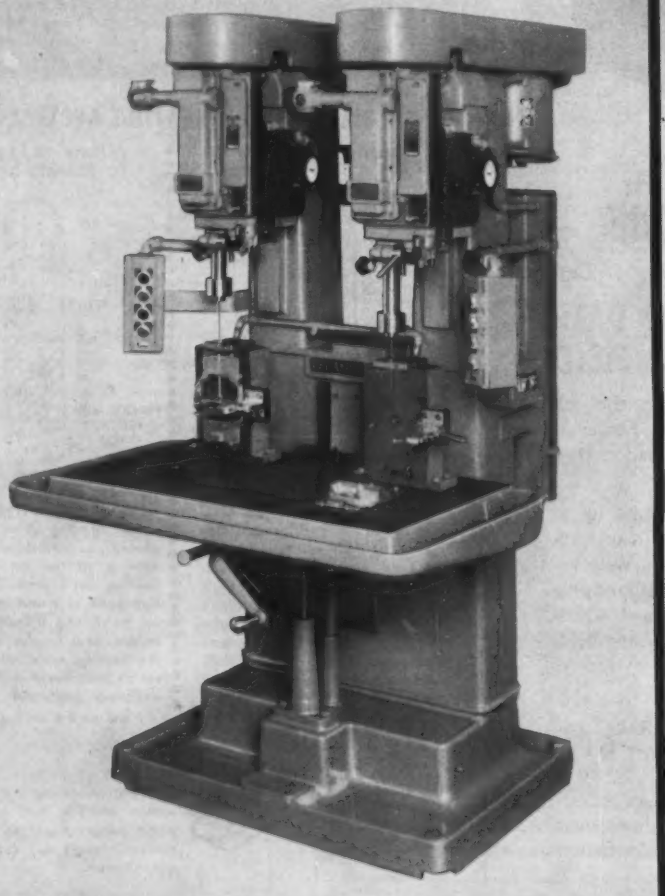
at 250 pieces per hour

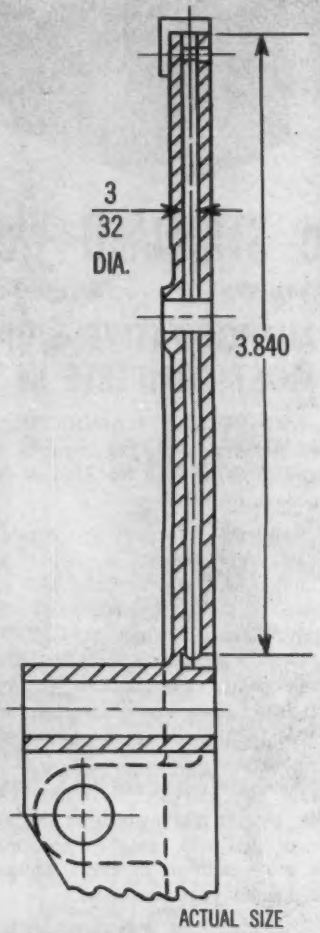
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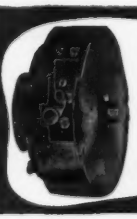
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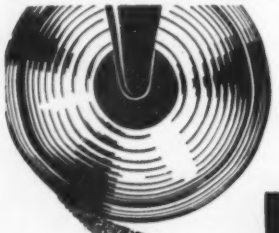
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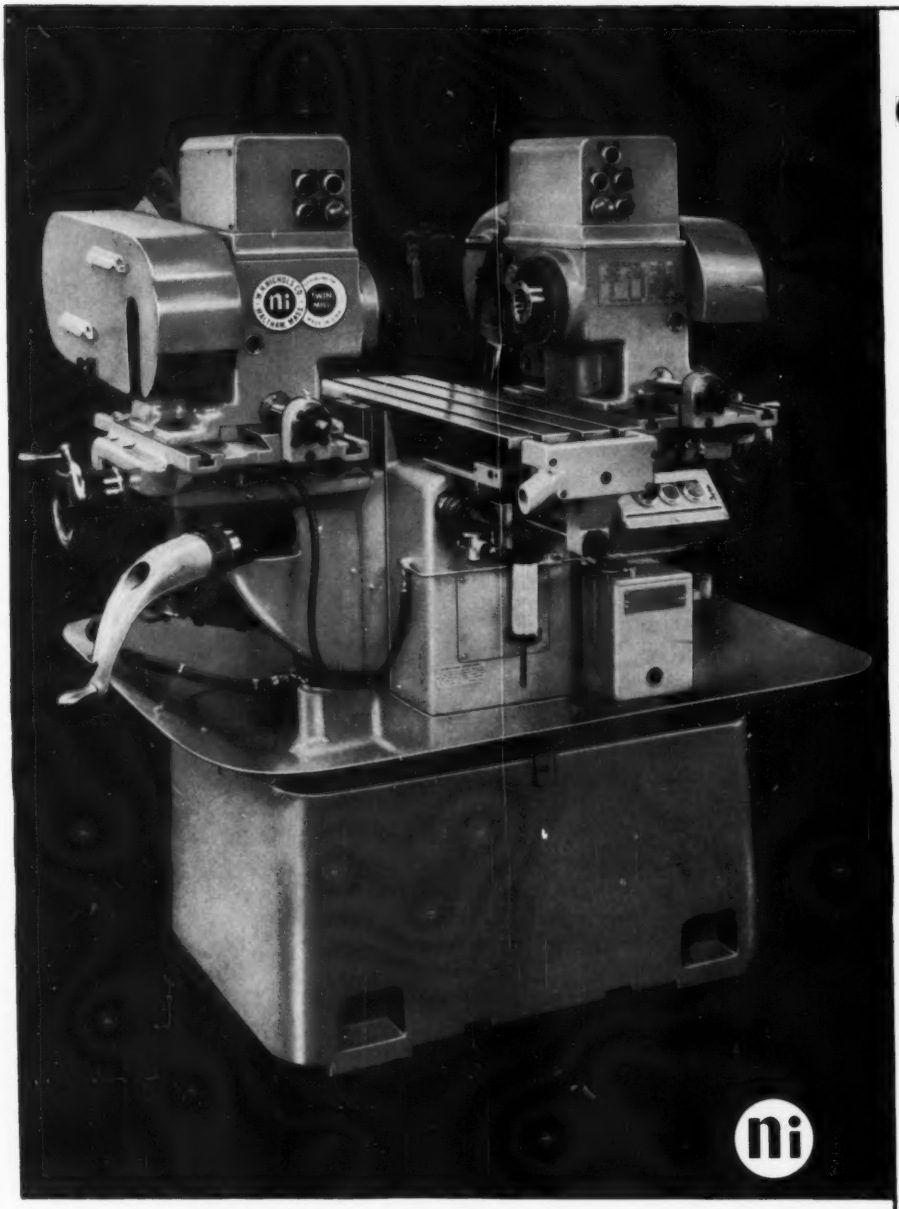
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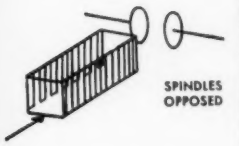
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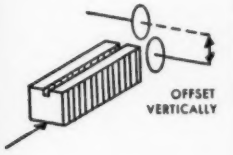
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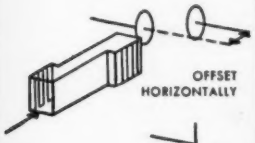
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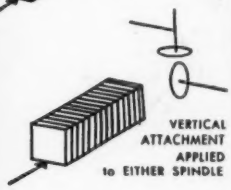


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3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken® bearings

PICTURED below are three applications where Timken bearing equipped Dodge pillow blocks stay on the job with little attention under tough conditions. Their tapered design lets Timken® bearings take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity. Wear is reduced, maintenance is cut to the minimum.

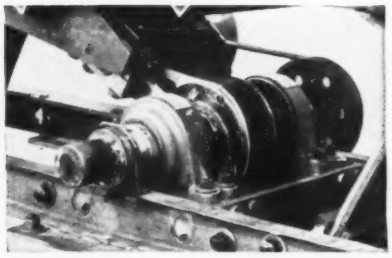
Cutaway view shows the Dodge All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface —never needs adjustment.

Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

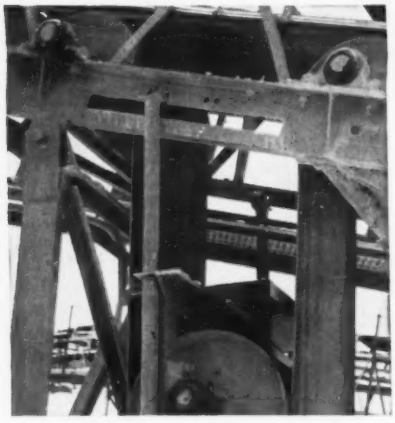
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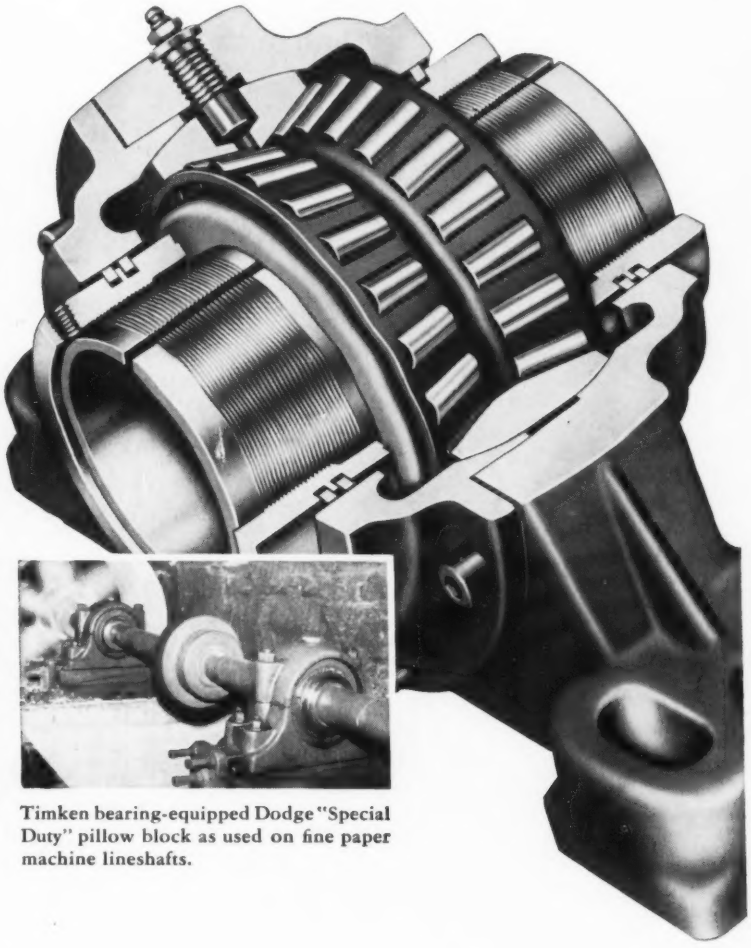
This symbol on a product means its bearings are the best.



Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.



Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.



Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

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